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PASPALUM AS A PASTURE-GRASS.

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Paspalum dilatatum is a sub-tropical grass. It thrives best in warm districts with a high rainfall. The main growth is made during the heat of the summer. The plant is of strong growth, deep-rooting, and perennial. Individual plants spread laterally to a considerable distance by the development and growth of short underground rhizomes. In this way plants established a foot or more apart can in a year or two cover the ground with a dense sward. The leaves are long and broad. They are produced at first from the numerous crowns of the plant and later appear at regular intervals along the flowering-stalks. The plant in the leafy stage is very palatable and nutritious. Even when flowering it continues to produce palatable leaves. When kept closely grazed or mown the crowns produce a succession of leaves ideal for grazing stock. Paspalum can grow in the shade and can thus invade and supplant clumps of rushes and tall fescue and other swamp growth. It smothers out blackberry and bracken fern if assisted in the early stages. It can survive fairly long periods of flooding and inundation. On loose soils the roots penetrate for many feet in search of moisture. On soils with a stiff subsoil or hard pan it is often affected by dry weather and tends to become root-bound. It has, however, often penetrated shallow pans and stiff soils, and, if well provided with plant-food, thrives when other pasture-plants are dried up. It cannot withstand severe winters where the ground is frozen, but otherwise it is not killed by fairly severe frosts. The colder the winter the slower it is to come away in the spring. Paspalum is rapidly becoming more and more acclimatized to frosts, and in many districts in the Auckland Province it is not now cut back by frosts of seven degrees and more.

EARLY CONFLICTING VIEWS REGARDING VALUE OF PASPALUM.

From 1900 to 1920 or even later the merits and disadvantages of paspalum as a pasture-grass in the Auckland Province were discussed wherever farmers met. While some farmers acclaimed its virtues as a wonderful summer-feed producer on swamp land too wet in winter or too dry in summer to grow rye-grass and cocksfoot, others would have none of it. The latter drained and cleared and ploughed and cropped and sowed to English grasses. While some

on hill land planted and sowed paspalum, and in the early stages at least had green summer pastures, others pointed to the lack of growth in the winter and were satisfied with dry summer pastures, and later stressed the tendency to root-binding. Even the enthusiasts began to doubt the wisdom of the extensive spread of paspalum when its colonizing ability by seeding began to be realized. This was particularly so in North Auckland, where from the free seeding of hill-sown paspalum the better land in the valleys and flats was invaded. Through inability to stock the summer growth adequately the paspalum became rank. It crowded out all other species. When frosted growth or the dry harsh growth of summer had to be eaten in the winter indigestion and compaction in stock caused serious losses. In time, on the poorer hill land, paspalum became root-bound and unproductive. This was because it was starved. The difficulty of cultivating and cropping land once it was invaded by paspalum was also held against the grass. Despite these disadvantages enthusiasts continued to sow and introduce paspalum throughout the warmer northern and coastal parts of the Auckland Province, and as far south as Hawke's Bay and Taranaki. It found special favour in grassing, with little effort on the part of the farmer, river-flats and swamp land partially covered in logs, stumps, blackberry, rushes, and tall fescue, &c. Others, by not sowing and by rigorously grubbing out odd plants brought in by stock, endeavoured to keep it out.

Paspalum is a great colonizer where climatic conditions favour it, and particularly where for one reason or another other pasture species do not thrive. Gradually it has invaded the better class of hill country and the river-flats and swamp lands throughout the northern peninsula and coastal areas where the frosts are not too severe. It has also, through being sown or by colonizing, occupied considerable areas of the poorer hill land where, on account of fairly rapid root-binding and starvation of the paspalum, danthonia and brown-top would produce more feed. Fortunately danthonia is able to dominate paspalum on much of the drier hill country, and brown-top combines well with it on the moister slopes. Paspalum as a pasture-grass has limitations and disadvantages, but the fact remains that the introduction and spread of paspalum in North Auckland and the warmer parts of the Auckland Province generally has seen a tremendous increase in the production from dairying, sheep-farming, and cattle-raising. It can be claimed that the advantages have far outweighed the disadvantages.

Importance of Management.

The difficulties of control, management, and utilization of paspalum pastures have forced on farmers the development of management methods which have brought out more prominently the many excellent qualities of the grass. Faults attributed to paspalum, such as the smothering effect on other species, the shortage of winter and spring feed, the coarseness of the feed in late summer and autumn, root-binding and falling-off in production, have in recent years been more and more recognized as really faults in management. In the early stages, owing to the roughness of the land surface, the prevalence

of logs, stumps, &c., and the size of paddocks, the rank summer growth could not be controlled. Other species were smothered out, the pastures became pure paspalum, and the winter carrying-capacity was far too low to allow for efficient stocking in the summer.

Farther south, where the establishment of pure paspalum swards for summer-feed production was advocated, paspalum has not made much progress. The low feed-production for six or more months of the year of such pastures far outweighed the advantage of good summer-feed production, particularly in districts where the summer was generally fairly well provided for.

The outstanding feature in connection with the better management and utilization of paspalum is the realization on the part of the farmer that practically all the other pasture species he would like to have in his pastures can be established and maintained with paspalum. Further, the management necessary to do this is exactly what is required to get the most from the paspalum as a summer-feed producer.

Paspalum with Perennial Rye-grass and White Clover.

Perennial rye-grass and white clover on land capable of supporting these species, either sown in the original mixture with paspalum or introduced later by surface-sowing, have been maintained indefinitely. The growth period of the perennial rye-grass is much earlier than that of the paspalum. The rye-grass grows in the winter and early spring, and as it dries off the paspalum takes up the running. The white clover combines well with the paspalum, growing over and amongst the crowns and providing the paspalum with much-needed nitrogen. This combination can be achieved and maintained only under fertile conditions, and provided always that the paspalum is not allowed either by stocking or mowing to grow rank and coarse season after season. When well managed, this is an excellent pasture, with a long production-period.

Because in northern districts the paspalum comes away early, cocksfoot is apt to find the competition too severe, but farther south cocksfoot and paspalum can be grown to advantage in the same field, the cocksfoot coming away earlier than the paspalum and growing on later into the winter. Where the perennial rye-grass and white clover cannot grow on account of flooding, or because of inability to mow or graze efficiently on swamp land, *Lotus major* combines well with the paspalum, but every effort should be made to provide conditions suitable to rye-grass and white clover.

With top-dressing, controlled grazing, and the use of the mower, many thousands of acres of dairying-land are now growing what is the ideal combination, perennial rye-grass in the winter and spring, so strong that no paspalum is to be seen, and, as the rye-grass goes off, white clover and paspalum throughout the rest of the year. There are still many more thousands of acres where this type of pasture should be the aim.

Paspalum with Subterranean Clover, etc.

Where the fertility is not up to the rye-grass standard subterranean clover, which commences growth in the autumn and continues until the early summer, makes an excellent companion to paspalum, providing well for the period of low feed-production by the paspalum. On hill country brown-top and crested dogstail, *Lotus major* and *L. hispidus*, also combine well with paspalum, providing again that the paspalum is controlled.

A feature of the development of the idea of using paspalum as one of the species in a mixed pasture has been the use in recent years of true perennial strains of perennial rye-grass and white clover. The introduction of these strains to paspalum swards by ploughing, and more recently with the development of suitable implements by surface cultivation, is being successfully practised. Conversely, the establishment of paspalum in rye-grass and clover pastures by surface-sowing in the late spring or feeding out paspalum hay has also been extensively practised on farms which have hitherto kept paspalum out.

A more general recognition of the fact that paspalum can be controlled, that other useful species can combine with it, and that all-the-year-round pastures can be obtained by the use of paspalum together with other species is likely to extend the range of usefulness of paspalum far beyond its present limits.

Treatment of Root-bound Paspalum.

One of the most difficult problems in connection with the management of paspalum is the condition known as root-binding. Where paspalum has become root-bound there is a decided falling-off in production. This condition is now recognized as being due to starvation. Although the root-bound paspalum is producing very little feed, it is safe to say that no other grass, with perhaps the exception of danthonia, would produce more under the circumstances. The renovation of such root-bound paspalum swards wherever practicable can be achieved by ploughing in narrow lands, cultivation, and the sowing of other species: perennial rye-grass and white clover, subterranean clover and brown-top, or the lotus species are suitable according to the future policy with regard to top-dressing. The cultivation renews the vitality of the paspalum and provides plant-food for the growth of other species for a time at least. Considerable areas of root-bound paspalum have also been successfully renovated by the use of special cultivating-harrows and rye-grass and white clover introduced. The success of this method and the future production of the pasture depends on whether top-dressing is practised to a very large extent. Continued top-dressing after renovation prevents a recurrence of root-bound paspalum, which is very slow in responding to manuring. The tearing-open of the matted surface roots allows the grass to make use of the fertilizer much more quickly and effectively. Paspalum stands all the cultivation that can be given it, and frequent and regular cultivation with the disks or penetrating harrows is one of the main methods of keeping it thriving and preventing root-binding.

Top-dressing and winter stocking with heavy cattle will also prevent this condition. On steep hill-country where root-binding tends to be a bad feature closing paddocks for a summer or two and stocking heavily with grown cattle when the ground is wet has been adopted with satisfactory results.

Control of Paspalum by Mowing.

The controlling of the paspalum, particularly by the use of the mower, has demonstrated more clearly the wonderful summer butterfat-producing capacity of paspalum itself.

The rank summer growth of paspalum, besides smothering out other species, is unpalatable and innutritious as autumn and winter feed. Wherever the mower can be used surplus summer growth should be put away as hay and silage. Paspalum hay is often described as being coarse and unpalatable. Difficulty is often experienced in making silage from paspalum. The coarse rank material, mainly flowering-stems, does not pack well, and the silage over-heats. These are not faults of the grass but of the farmer. Paspalum for either hay or silage should be cut before it comes into flower. For silage-making early cutting to get a mixture of other grasses and clovers with the paspalum, well before the latter comes into flower, is strongly advocated.

On good land a second and even a third cut of leafy paspalum that will make excellent hay or silage can often be secured.

In stacking leafy paspalum hay it will be found that a very high centre must be kept in the stack, and provision made for topping-off the stack, as the material tends to settle rapidly after stacking. It is far better practice to take two leafy crops than one heavy coarse crop of inferior feeding-value. On pure paspalum pastures the early growth is often too long to get a crop. By running the mower over a paddock intended for hay, prior to closing, the growth can be made to come away much more evenly.

Arable Cropping of Areas in Paspalum.

The impression is still prevalent that when once paspalum is established cultivation and cropping is out of the question. Old root-bound and neglected paspalum swards are admittedly difficult to plough and cultivate. The indifferent cultivation one often sees under such conditions serves only to stimulate the growth of paspalum, but it is not sufficient for a satisfactory crop even without the competition of the rejuvenated paspalum. Sufficiently early and thorough cultivation to prepare a satisfactory seed-bed for the crop also serves to keep the paspalum in check until the crop is grown.

Where paspalum has been kept in good order, ploughing and cultivation are not nearly so difficult, and satisfactory crops can be grown. The paspalum, which tends always to re-establish from seed and pieces of root, can be dealt with in the same way as other deep-rooting weeds. Up to 100 tons per acre of mangels and 80 to 90 bushels of maize have been grown on paspalum paddocks broken up for cropping. When seeded to grass again it is not necessary to resow the paspalum, since even after several years of cropping there is enough seed in the soil to give a good take of paspalum.

Sowing Paspalum.

Paspalum-seed germinates best in hot, moist weather; for this reason November and early December sowing was frequently advocated. Since paspalum should be established with companion species which are better sown in the autumn, the best practice is to include paspalum iu the mixture and sow in the autumn. Paspalum can be established quickly as a pure seeding if sown with millet or maize or even soft turnips in the early summer. When sown with other species in the autumn it is slow to establish. By sowing before the end of February or early in March a much better strike and quicker establishment of all species is obtained, and this early sowing specially favours paspalum. Seeds of paspalum will lie over the winter and germinate the following summer. When once scattered plants are established the thickening-up of the paspalum can be hastened to a great extent by letting the plants run to seed in the summer. On account of the dense sward, paspalum is difficult to establish with brown-top. From 4 lb. to 5 lb. of seed is sufficient in a mixture on ploughed land and 2 lb. to 3 lb. on burns.

Paspalum-seed.

The best seed is imported from Australia, where the seed crop ripens more evenly than it does here, and seed-harvesting methods are generally better. About 1920 the average germination of Australian seed coming to New Zealand was about 40 per cent. Samples of local seed ranged in germination from 0 per cent. to 20 per cent. or 25 per cent. At present local samples are being obtained ranging from 20 per cent. to as high as 50 per cent. At the same time, however, Australian samples up to 70 per cent. have been on the market. The necessity for buying and selling paspalum-seed on a germination basis should be apparent. The main difficulty with local seed, which is preferable on account of the acclimatization of the plants, is the uneven ripening, the loss occasioned by unfavourable harvesting weather, and the varied harvesting methods. Tests have shown that the germination of the pure paspalum-seed in local samples is practically as good as that of imported seed. In local seed, however, the amount of empty seed-covers and immature seed is often as high as 60 per cent. to 70 per cent., whereas in the best imported seed rubbish is reduced to 20 per cent. to 30 per cent.

Conclusion.

Though considerable progress has been made in recent years in the management and utilization of paspalum as a pasture-grass, much yet remains to be done before a considerable proportion of our farmers are taking full advantage of its possibilities as a wonderful summer-feed producer. The conserving of surplus summer growth when still palatable and nutritious, the combination of paspalum with other species with a different growing-period, and the maintenance of fertility to prevent starvation of the paspalum are the lines along which further progress with this grass will be made.

VINE-CULTURE UNDER GLASS.

(Concluded.)

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DISEASES, DISORDERS, AND PESTS OF THE VINE.

OIDIUM OR POWDERY MILDEW (UNCINULA NECATOR).

Powdery mildew appears in the form of greyish patches of mould on leaves and young shoots. When it is neglected the whole surface of the leaves may become covered with the mould. On the berries it at first appears as a white powder, somewhat like lime, but when much developed it becomes like a grey felt and completely envelops the berries. While it is one of the most destructive vine-diseases when not subject to effective control, it is not feared by expert growers. Probably there are no crops which are entirely free from mildew, but where the vines are under skilled management infection is of a trifling character and easily controlled. The frequent cases in which crops are ruined by this disease are entirely due to mismanagement.

Attacks are most likely to occur during the early period of growth, when leaves, shoots, and fruit are all young and tender. If the attack is severe, and is not checked, it will persist during the whole season. Autumn attacks are also common, occurring in houses which have been free from the disease till that time.

A humid, stagnant atmosphere with a temperature above 58° F. is favourable to the development of Oidium. Fresh air is essential to the control of this disease, but draughts must be excluded or Oidium is almost sure to make its appearance.

As a preventive of the annual recurrence of Oidium, dry sulphur should be applied early in the season to the vines, and particularly to the breaking buds, where the fungus hibernates; and some should be scattered along the top and bottom plates and over the floor of the vinery. The fumes or emanations which arise from the sulphur at a temperature of 80° F. and over destroy the fungus. The shoots should be dusted again when 4 in. to 6 in. long, and again when the flowers open. Applications can be made later at fortnightly intervals, if considered necessary.

Under dry conditions, when vines are syringed with water to assist the buds in breaking, sulphur can be applied with the water daily until the shoots are 3 in. or 4 in. long, after which dry sulphur can be used. To mix the sulphur, dissolve 1½ oz. soap in 4 gallons of water; then with a little of the water added to 1 lb. of sulphur make a paste and add to it the remainder of the water, gradually mixing the whole thoroughly.

As dry sulphur is liable to cause irritation in the eyes, rubbing them should be avoided, and when dusting is completed all sulphur should be carefully removed from the face, and the eyes, if affected, bathed in a weak solution of bicarbonate of soda, borax, or a little sweet milk.

A solution of potassium sulphide or liver of sulphur dissolved at the rate of 1 oz. to 3 gallons of water, and, alternatively, lime sulphur at the rate of ⅓ pint in 4 gallons of water, are both good controls, and do not affect the eyes, but both disfigure the white lead paint with which vineries are generally painted (it is claimed that zinc paint is not affected by sulphur sprays).

These liquid sprays are applied at the same periods of growth as the dry sulphur, with the exception of the flowering period, when dry sulphur only should be used.

Where the fungus is already in evidence it can be killed by spraying with hot water (160° to 170° F.) during the hottest part of the day (11 a.m. to 3 p.m.). By mixing 2 parts of boiling water and 1 part of cold water, this temperature can be obtained approximately. Dusting the vines with dry flowers of sulphur should follow after sunset. Finely divided sulphur gives the best results, and is most easily and effectively applied with a sulphur bellows or a dust-gun.

The fungus can also be destroyed by a solution of Condy's crystals (permanganate of potash) made with sufficient water—to which ½ oz. of slaked lime per gallon has been added—to reduce the colour to a light pink. This spray is very effective, but care should be taken in applying it, as it marks the paint. It does not act as a preventive, and should also be followed by sulphur.

GREY ROT (BOTRYTIS CINEREA).

On the leaves and grapes grey rot shows as a grey mould and later changes to a mouse-coloured, fluffy mould. It causes ripe grapes to shrivel to dark purple-coloured mummies, which remain attached to the stems. The disease cannot occur except in a very damp and stagnant atmosphere. Where it occurs the conditions of the house should be altered by proper ventilation, and all affected grapes cut out. The mould form of the disease can be checked by spraying with liver of sulphur at the rate of ½ oz. to a gallon of water. All dead leaves and prunings should be collected and burned and the house thoroughly cleaned. These precautions should be taken even in the case of vines not affected by disease.

EXCORIOSIS (PHOMA FLACCIDA).

Excoriosis attacks the laterals of the vine mainly at the base between the internodes, where either greyish patches covered with small black points or dark brown patches—or both—form. Later the bark cracks, and the wood is disintegrated so that the laterals frequently fall off. These laterals and their fruit should be burnt with all the affected parts of the vine, which are liable to perpetuate the disease. At pruning-time affected laterals should be cut back to the base bud as usual, and the whole vine swabbed a little later with a solution of 30 per cent. of sulphate of iron reinforced with 1 per cent. to 2 per cent. of sulphuric acid. Quantities for 4 gallons of the solution are—12 lb. of sulphate of iron, ½ pint of sulphuric acid, and 4 gallons of water. The sulphuric acid is poured on to the sulphate of iron and the water then added. A wooden vessel painted inside and out with paraffin-wax or tar makes a suitable container. As the mixture is corrosive it should be kept off the hands, clothes, and boots.

Later, when the young shoots are about 3 in. long, spray with a 4-per-cent. solution of sulphate of copper to which enough washing-soda has been added to turn a red litmus paper blue, covering more especially the base of the shoot from where the foliage has been taken off. Follow with three or four sprayings of the same strength at intervals of a fortnight. The sulphate of copper-washing-soda solution is known as Burgundy mixture, which is prepared as follows (the quantities given are for 4 gallons of the mixture): Dissolve 1 lb. 10 oz. of sulphate of copper in 2 gallons of water and approximately 13 oz. of washing-soda in 1 gallon of water. Then pour the soda solution into the copper solution, stirring vigorously, and complete to 4 gallons by adding sufficient water.

RIPE-ROT.

Ripe-rot is caused by the fungus *Glomerella cingulata*. It first appears on ripe grapes as brown spots, which increase in size, rupture the cuticle, and cause a rot. Once a berry is attacked there is no remedy, and affected berries should be cut off. It is not practicable to spray ripe grapes, therefore the only remedy is to increase the ventilation and prevent as far as possible an accumulation of moisture during the night. This involves keeping late growths from crowding the trellis.

SHANKING.

Sometimes the footstalks of the berries and even the stems of the bunches wither through lack of nourishment; they are then said to have shanked. Shanked berries fail to colour or ripen properly, and are sour and uneatable. Different opinions are held as to the cause of shanking, but all agree that it is a root trouble, and that it is induced by the roots being in sour soil. Sour soil need not necessarily be wet soil, though excessive wetness will cause shanking, and should be remedied by attention to drainage. Roots growing down into cold subsoil may be the cause, and they should then be encouraged to remain nearer the surface. Cases are recorded where shanking has been extensive for a number of years, but had since been avoided by the simple means just indicated.

SCALDING.

Scalding occurs both on leaves and on berries, and in some cases is extensive and causes serious losses. This disorder, like shanking, is usually spoken of as a disease, but this is not correct, as no pathogen has been found in either case. Scalding, or scorching, may be due to the direct action of the sun or to variations in temperature. When it occurs on leaves it is in nearly all cases due to the action of the rays of the sun upon foliage; it may develop at any time during the day. If foliage is allowed to crowd against the glass the free passage of air is checked, and the leaves remain wet till dried by the heat of the sun—scalding is sure to take place in such circumstances. To a lesser extent leaves may be burned by the focussing of the sun's rays through faults in the glass. The common glass used is full of such faults, and it is rare that some amount of burning does not occur from this fault, but never to a harmful extent. Berries exposed to the direct

rays of the sun may also be scorched, this generally occurring near or during the ripening-period. Scorching involving considerable damage has also taken place when the vine-leaves were very thin. Leaves which are of a flimsy texture are unable to withstand the heat of the sun, and burning results. Such poor condition of the foliage is due to a want of plant-food, and can be remedied by supplying what the vines need. Another cause of this condition is dryness at the roots and an arid atmosphere, resulting in semi-starvation, with consequent feeble leafage, which is bound to scorch. It would perhaps be better to speak of this result as "scorching," which it really is, rather than as "scalding"; it is not the trouble usually meant by authorities when speaking of scalding.

Scalding proper occurs during the stoning-period, and sometimes causes very serious losses. It has been stated previously that the stoning-period is a critical time. The berries, during the three or four weeks of stoning, make practically no increase in size and are very susceptible to injury, so that any attempt to force them into growth is likely to result in damage being done. Scalding in this case is not due to direct sunlight, for berries that the sun cannot reach are scalded. It is due to a too-wide range between day and night temperature, combined with atmospheric moisture. Damping-down should therefore be reduced to a minimum and a little top-air should be left on all night, except during bad weather. More air should be given very early in the morning to dispel moisture, and, above all, to prevent a sudden rise in temperature. The greatest danger is a sudden rise of temperature in the morning.

THUMB-MARK.

Thumb-mark is a physiological trouble believed to be due to sudden changes of temperature, and generally appears after bright sunshine following dull cold weather. Depressions ("thumb-marks") appear on the surface of the grapes, which gradually turn brown and wither. Affected berries should be cut out. There is no cure. Grapes are liable to be affected from after the stoning-period until they begin to change colour.

WARTED LEAVES.

A common trouble known as "warted leaves" occurs mostly in the warmer districts. The leaves have a rough surface, covered with warts or intumescences. The leaves affected are usually of a gross character, indicating that the roots are functioning in rich soil. Such leaves are heavily charged with water, and are very susceptible to injury. The damage usually is caused by a current of cold air admitted before the foliage has dried.

AERIAL ROOTS.

It is not uncommon to see vines with bunches of aerial roots hanging down from each spur. The cause may be a warm and moist atmosphere combined with lack of proper ventilation. In most cases, however, it is due to faulty root-action, the roots having grown into cold soil. This again may be due to poor drainage. In any case it is not a desirable state, and should, if possible, be put right.

MEALY BUGS.

Mealy bugs are insects which are aptly described by the name applied to them: the term "mealy bug" serves to distinguish them from any other grape-vine pest. The rapidity with which the insects propagate, and their habit of depositing their eggs under the bark, beneath the scales of buds, and in crevices in the building, particularly the rafter, make them the most difficult of all insects to get rid of. It is practicable to free small vineries of mealy bugs, but in the case of large houses it is impracticable to devote the time needed to carry out the treatment that proves effective in small houses.

In small vineries scrubbing the rods with hot water has been found by many growers to be effective. It is necessary first to remove loose bark, then to scrub the rods with a fairly stiff brush, using water at a temperature of about 130° F., which is hot enough to kill the bugs but does not injure the buds. In bad cases the rods should be scrubbed twice—at the time of pruning and again a few weeks later. Before the buds begin to move the rods should be dressed with a solution of lime sulphur, 1 in 10, applied with a paint brush. All prunings and leaves should be carefully collected and burned, and everything needful done to thoroughly clean the house, so as to get rid of bugs that have fallen to the ground. The rods must, of course, be taken down for cleaning; before tying them up again thoroughly and forcibly spray the whole interior, avoiding the rods, with a solution of kerosene emulsion at a strength of 1 in 12.

To control mealy bug when the grapes are green, spray with ½ oz. of nicotine sulphate, 40 per cent., added to four gallons of water in which sufficient soap (about 1 oz.) has been added to make it frothy.

This spray, whilst destroying some of the bugs, acts principally as a deterrent, and may be used about every fortnight until the grapes are partly coloured, when hydrocyanic gas can be employed. Spraying with hot water at 130° F. is also a good control which kills both bugs and eggs without damaging the foliage or fruit.

Where a good pressure of cold water can be obtained the mealy bugs can be flushed off the vines on to the wet floor, where they generally die. The water may be applied at midday in warm weather, and followed up the next day with the nicotine spray.

Cyanide Fumigation: The Pot Method.

In large houses fumigating with hydrocyanic-acid gas appears to be the only way to get rid of the pest. This gas is of a deadly nature, and human life is endangered by any carelessness. It is therefore best to avoid its use where other methods can be made effective. A good deal of care in its use is necessary while the vines are in growth, as it readily injures tender foliage, either of the vine or of other plants in the house, and may also injure the berries. In theory, damage from its use can be avoided, but it proves to be difficult in practice. Cyaniding should not be attempted before the berries are partly coloured, when 2½ oz. is effective and safer than 3 oz. per 1,000 cubic feet. It is noticed

that authorities in England now advise its use only after the grapes have been cut, and no doubt this is the wisest course. As fumigation does not kill the eggs, a second treatment should be given after an interval of about a fortnight.

Fumigation should be done after sunset on a calm day, when the heat from the sun has declined; the temperature should not be above 60° F. or 70° F. if the grapes are still hanging. The house should be made air-tight, and the vines and buildings should be as dry as possible. After treatment the house may be kept closed all night, but must be opened before sunrise on the following morning. When opening the doors care must be taken not to inhale the air of the house, and the house should not be entered until at least one hour after the doors have been opened.

For every 1,000 cubic feet of space in the house use 3 oz. avoirdupois of sodium cyanide (or, if not obtainable, 4 oz. of potassium cyanide), 4 fluid oz. of commercial sulphuric acid, and 12 oz. of water. Provide an earthenware basin for every 10 ft. of length in the house, the basin to be of a size proportionate to the amount of chemicals it will be required to hold. The necessary quantities of cyanide should first be weighed out and wrapped loosely in pieces of tissue paper, which should then be placed near the basins. If the cyanide is in large lumps these must be broken until they are not larger than a filbert nut. The water should first be placed in all the basins, and then the sulphuric acid added. The cyanide in the paper should be added last of all, beginning at the basin farthest from the open door and working quickly towards it, as the gas spreads rapidly. The paper will delay the action of the acids for a moment or two. When sulphuric acid is added to the water heat is generated, and it is important that the cyanide be added before this heat declines; if it has cooled down the generation of gas will be slower and less in volume. A good grade of sulphuric acid should be used; lower grades may contain nitric acid, which would cause burning.

After preparing the cyanide it is advisable to wash the hands carefully, and the remaining cyanide, including the smallest crumbs of it, should be stored safely. The extremely dangerous nature of the cyanide and hydrocyanic acid for both animals and man should be kept in mind when operating. To obviate the risk of any person entering the house the doors should be securely fastened. Suitable measures should also be taken to prevent any one entering the open doors while the gas is being liberated.

Fumigating with Calcium Cyanide.

The application of calcium cyanide as a means of controlling mealy bug in vineries is as efficacious when used in a gas-tight house and is a more simple and less dangerous method than the pot method of cyaniding. Reasonable precaution should, however, be taken as the gas similarly causes death when inhaled. There is a risk of burning the foliage and grapes when they are young and tender. It sometimes happens that the mealy bugs are very much in evidence while the grapes are still green. Under these circumstances growers can afford to take some risks to obtain a clean and profitable crop.

The exact quantities which will exterminate the mealy bug without danger to the crop can be ascertained for each house by the grower himself by working up gradually to a dose sufficiently strong to kill the insects without burning the tender foliage of grapes. The necessary quantities, which should be duly recorded for future reference, will be found to differ considerably on account of the variation in the gas-tightness of the houses, which should be rendered as tight as possible.

In the tender stage of vegetation $\frac{1}{8}$ oz. per 1,000 cubic feet might be tried to start from, and when the grapes are beginning to colour —a much safer period—$\frac{3}{4}$ oz. When the grapes have been picked 4 oz. per 1,000 cubic feet can be tried. These amounts will probably have to be increased, as many vineries are far from gas-tight, and 8 oz. per 1,000 cubic feet have been found necessary in some cases.

In every case a second fumigation after a period of about twelve days is necessary to kill the young mealy bugs which may hatch out after the first application, as the gas does not sterilize the eggs.

To obtain maximum results fumigation should be commenced one hour after sunset, and the houses opened up in the morning before the sun strikes the vinery. Strong light, combined with cyanide gas, causes burning of the foliage. The foliage must be dry, as moisture absorbs the gas and the dilute acid causes burning. The soil of the vinery should be only slightly damp, and no standing water left in the house, as this would absorb the gas and weaken the dose. If the soil in the vinery is dry it can be watered not later that twenty-four hours before fumigation. The most favourable temperature at which to fumigate lies between 55° F. and 70° F. A calm night is an essential condition for success; strong winds are apt to increase the leakage of gas.

To fumigate, place the required quantity of calcium cyanide in a wide-mouthed jar, or, in the case of a long house, in several closed jars or tins placed at intervals, and, walking from the closed end of the vinery to the door, scatter the contents evenly over the soil. Then close and lock the door and place a warning notice on it. As the gas is given off slowly from the calcium cyanide, there is ample time to scatter the chemical, without danger, at an ordinary walking pace. The gas will generally have disappeared by the following morning, but it is an advisable precaution to give the vinery an airing before entering.

To calculate the amount of calcium cyanide required, measure the body or lower part of the vinery, which may be 80 ft. long, 25 ft. wide, and 4 ft. high; then, 80 ft. × 25 ft. × 4 ft. = 8,000 cubic feet. Now measure the upper or roof part of the vinery, taking a vertical line to the apex from a line drawn from top-plate to top-plate, say, 8 ft., of which take half and multiply the square of the body by that half—80 ft. × 25 ft. × 4 ft., which equals another 8,000 cubic feet. Then 8,000 added to 8,000 equals 16,000 cubic feet, the cubic content of the vinery. In a lean-to vinery the same method is applicable by measuring on the wall side from the level of the top-plate on the other side.

RED SPIDER (TETRANYCHUS TELARIUS).

This is a minute brick-red insect that attacks the leaves. If present in great numbers the vines are debilitated, because of the insects sucking the sap from the leaves. It is troublesome only where hot, dry conditions prevail, and in most parts of New Zealand need not be a source of trouble. The way of avoiding attacks is to supply sufficient moisture to the roots, and to prevent arid conditions in the house by damping down and syringing. The warmer parts of the Dominion are most favourable to the pest, and the very conditions that favour the spider make it possible to use more water in the house. Lime sulphur, containing 15 per cent. of polysulphide, 1 in 150, sprayed on to the vines before closing the house in the evening is a good control.

THRIPS.

The thrip is a tiny cigar-shaped insect, dark in colour when mature. It, like the red spider, is a sucking insect, but is more destructive than that pest. Like the red spider, thrips thrive in dry conditions, and treatment that will prevent attacks by spider is usually effective for thrips. If an attack occurs spray with nicotine sulphate, 40 per cent., 1 part by volume in 800 parts of soapy water—1 oz. of soap to the gallon. On account of its disagreeable flavour this spray should be used at least a fortnight before the grapes are eaten.

A thorough cleaning of the vines and house on the lines previously indicated for the control of the mealy bug is essential to the riddance of both thrips and red spider.

OBSERVATIONS RELATIVE TO PASTURE SEED-MIXTURES.

E. BRUCE LEVY, Grasslands Division, Plant Research Bureau.

THE ultimate structure in vegetation is determined by dominance, and dominance is based on the ability of the individual to respond to its environment. No two plants are exactly alike in their demands: each plant has its special growing-place. The indigenous forests in general carry a single dominant that largely determines the physiognomic features of the formation—the tawa or rimu, or white pine, or kauri, or totara, or southern beech. In forest development we recognize succession, and dominants appear to mark each phase in the succession: thus we have the manuka dominance, bracken fern, the indigenous induced hard fern, piripiri dominance, wineberry, mahoe, five-finger dominance, progressing to rewarewa, hinau, or kamahi dominance. In the tussock grasslands we see the same rise to dominance according to growing-place — the fescue tussock, the poa tussock, the danthonia tussock; and in the depleted lands of the South Island we see the scabweed dominant under the influence of the rabbit. In the artificial grasslands of New Zealand the trend to dominance is well observed — the rye-grass, cocksfoot, brown-top,

Danthonia pilosa, *D. semiannularis*, ratstail, paspalum, tall fescue, prairie-grass, floating sweetgrass, and *Poa aquatica* dominance respectively.

Dominance within a mixed association presupposes competition and ultimate survival of one plant over another. Survival is based on the ability to persist longer and to grow better than another plant under the conditions of the habitat, and the plant that is gaining ground and canopy in the association is rising to dominance, and, further, the plant rising to dominance is producing more growth than any of its competitors can or will unless there comes about a modification in the habitat. The real problem of the grassland farmer to-day and of the future is to learn just how to secure dominance of those pasture species that have proved themselves capable of high productivity when subject to conditions appertaining within a utilization plan whereby stock is the main defoliating-agent. He can also employ dominant swards where the mower is the harvesting-implement, and lucerne stands out pre-eminently in this respect. Lucerne is one of the few permanent agricultural crops where dominance is recognized as essential for the plant's own well-being.

The trend to simplification of pasture swards is the recognition among grassland workers and ecologists the world over—and it is fitting to mention the name of Professor R. G. Stapledon, of Aberystwyth, in this respect—of the laws governing plant-life and plant communities.

Complexity in the pasture sward or in any plant association is in general a sign of non-aggression by any particular plant member, and when no one member of an association is aggressive there is probability of a weak, moribund community. There is ample evidence that the less thrifty and the more open the grassland association the greater the numerical strength of the species, and conversely the more thrifty and dense the association the fewer species that association contains. Pasture-making is largely a question of harmonizing plant and environment, and the problem is to provide the environment that the high potential producer demands, and the more closely plant-demand and environment harmonize the simpler the association becomes and the simpler can the seed-mixture be that is employed.

Accurate knowledge is essential for the success of the simple seed-mixture: safety and latitude is afforded in the more complex seed-mixtures, but waste of seed must of necessity result, and care must be taken that an actual reduction in yield does not come about as a result of using the complex seed-mixture.

The claim for complex seed-mixtures is sound, however, where we are dealing with a complexity of soil types and a complexity of ecological conditions such as exist on bush-burn country—the fertile flats and hollows, the steep faces and exposed knolls, the shady and the sunny aspects. These cannot be uniformly grassed, and many seed-merchants have been libelled in regard to the seed-mixture provided for bush-burns or sowers reprimanded for uneven distribution of the seed. The irregular stand secured is but the reflex of one or more species in the seed-mixture becoming dominant according to aspect, and thus giving the impression that the sowing or mixing of the original seed-mixture supplied was at fault. In general also in sowing down to permanent pastures phases in the succession to an ultimate dominant should be provided for.

For the ploughable country where one can govern the habitat and management at will, the case is strong for the simple seed-mixture composed of one or two grasses and one or two clovers. The intimate mixture of grass and of clover is imperative, and no effort should be spared to get the best possible strains and to secure the best possible conditions for the establishment of these. It is of great practical significance that the grasses and the clovers are ecologically related, and no mixture-maker can afford to ignore this fact.

Control of the environment is presumed before simplification of seed-mixtures can be carried far. Soil-fertility and the correct soil-moisture, together with regulation of light and shade by means of pasture-utilization, are three master factors. The perennial rye-grass - white-clover mixture demands control of all three. The cocksfoot - red-clover - white-clover mixture demands an intensification of the shade factor, which means laxer utilization. This also applies in the case of such pasture-plants as timothy, prairie-grass, *Phalaris tuberosa*, and, to some extent, paspalum. The danthonia-clover - dominant sward demands an intensification of the light factor, and utilization by close grazing is a prerequisite. The brown-top - Chewing's-fescue mixture (as for lawns) demands control of the fertility factor if a correct balance is to be secured between these two species. This consideration on behalf of each species calls for niceties in management which can be given to a maximum degree only if the species of similar demands are grouped in simple mixtures by themselves and specially managed so that the correct environment for their maximum development is provided, and this necessitates special-purpose pastures of simple seed-mixtures, separately fenced in order that the correct management may be given to each. Already the claim of lucerne in this respect is recognized.

Experimental Evidence relative to Simplification of Seed-mixtures.

Evidence to support the simple seed-mixture and the futility of wasting seed in complicated seed-mixtures where we are able to give reasonable manurial and management conditions to the grasslands laid down is contained in the following trials :—

Trials at Marton Experimental Area.

Three years ago six seed-mixtures were laid down at Marton. They were exceedingly well managed under a system of mowing and grazing introduced there by Mr. A. W. Hudson, and were systematically manured. The results are tabulated in Table I.

From Table I it will be noted that under the conditions of the trial which favoured the rye-grass - white-clover sward it proved detrimental to add certain additional species to the simple basic seed-mixture, and this is definitely the case in regard to Plot 6, where the addition of *Poa trivialis* has detracted from the total three years' yield by approximately 4 per cent.

At Marton there was laid down at the same time as the seed-mixture trial given in Table I a series of cocksfoot - white-clover - red-clover plots to test out the significance of strain in cocksfoot and red clover. The

three years' yields of these plots are comparable to those in Table I, but the management has been more lenient, although probably not quite lenient enough for cocksfoot to produce its best.

Table I.—Showing Tabulated Results of Seed-mixture Trial at Marton after Three Years down.

Seed-mixture sown. (Quantities in Pounds per Acre.)	Total Dry Matter of Mixture (in Pounds).	Relative Yields.	Species: Contribution per Cent. at 8th July, 1936.
(1) Perennial rye-grass .. 30 White clover 3	33,139	100·1	82·9 12·5
(2) Perennial rye-grass .. 30 White clover .. .. 3 Cocksfoot 10	33,103	100·0	72·2 22·5 2·7
(3) Perennial rye-grass .. 30 White clover .. .. 3 Cocksfoot .. .. 10 Italian rye-grass .. 6	32,738	98·9	80·7 11·1 5·0 ..
(4) Perennial rye-grass .. 30 White clover .. .. 3 Cocksfoot .. .. 10 Crested dogstail .. 3	32,784	99·0	81·8 11·1 2·3 Trace.
(5) Perennial rye-grass .. 30 White clover .. .. 3 Cocksfoot .. .. 10 Timothy 4	32,663	98·7	74·7 17·4 3·3 1·4
(6) Perennial rye-grass .. 30 White clover .. .. 3 Cocksfoot .. .. 10 *Poa trivialis* 4	31,804	96·1	67·3 4·9 1·5 25·7

The results are shown in Table II :—

Table II.—Showing Results of Seed-mixture Trials at Marton after Three Years down.

(Trials sown 23rd March, 1933.)

Data from Trial.	Seed-mixtures.		
	Rye-grass-White-clover.	Cocksfoot-White-clover.	Cocksfoot-Red-clover-White-clover.
Total dry matter (in pounds)	33,139	(1) 30,438 (Akaroa) (2) 30,310 (Aberystwyth) (3) 27,841 (Danish) (4) 30,512 (selection)	(1) 30,403 (Montgomery). (2) 30,225 (Broad). .. ..
Percentage botanical composition	Rye. White. 83 13	Cocksfoot. White. (1) 51 37 (2) 50 39 (3) 40 52 (4) 55 33	Cocksfoot. White. Red. (1) 50 35 5 (2) 53 34 2 .. ..
Relative total yields	100	(1) 91·8 .. (2) 91·5 .. (3) 84·0 .. (4) 92·1 ..	(1) 91·7 (2) 91·2 .. ..

The utilization in the above trial (Table II) may have been over intense for cocksfoot to develop its maximum production, and it appears that this is certainly true of red clover, the addition of red clover making comparatively litt'e difference in the yield other than to depress it slightly. However, in the case of the cocksfoot it must be said that if the growth were allowed to get much taller the quality of the herbage would probably have deteriorated.

In these trials at Marton it would appear as if the yield can actually be depressed by the addition of species that are in themselves not as productive as the dominants in the mixture. In other words, species for a while at least may occupy ground that would better be occupied by the dominants, no consideration, of course, being given to any value that may be attributed to additional species from a dietetic point of view.

TRIALS AT MASSEY AGRICULTURAL COLLEGE.

In the autumn of 1934 a series of seed-mixture plots was laid down at Massey Agricultural College under—(1) dairy-farm management and (2) under sheep management. Point-analyses to arrive at ground-cover and dissection-analyses to arrive at actual botanical composition of the feed available to stock were made on these plots in May, 1936. The mixtures sown out and results to date are contained in Table III.

It will be observed that the addition of species to the general base has made little or no difference to botanical composition, and it would appear to date as though the cocksfoot and Montgomery red clover would not have been greatly missed had these been left out also.

The white clover used in the base mixture was certified permanent-pasture type, and it would appear that strain in the dominant species is likely to alter the botanical composition more than do any additional species. In this respect it is interesting to note the difference in the white-clover strains in respect to ground-cover and actual production as determined in the month of May. The higher actual productivity of the certified "mother" strain and the pedigree strain is determined by the cut and dissected analysis as against the certified perennial pasture strain is noteworthy, and in this respect Kentish wild white clover compares very unfavourably. In this strain in May the ground-cover is high but the yield is low.

Table III.—Botanical Composition of Fields derived from Pasture Mixtures sown down Autumn, 1934, and utilized since under Good Dairy-farm Management.
(Botanically analysed May, 1936. A = Ground-cover analysis; B = Cut and dissected analysis.)

Plot.	Base Mixture.										Species added to Base Mixture and their Contribution.			
	Italian Rye-grass (5 lb.).		Perennial Rye-grass (25 lb.).		Cocks-foot (10 lb.).		White Clover (3 lb.).		Montgo-mery Red (3 lb.).					
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.		Lb.	A.	B.
1 ..	..	..	46	64	6	7	45	20	2	1	Base only ..	..	..	..
2 ..	..	..	43	71	9	7	39	18	1	3	No Italian ..	..	..	..
3 ..	..	..	53	71	7	7	35	17	..	1	Dogstail ..	3	2	..
4 ..	..	..	49	69	5	12	32	10	3	Tr.	Timothy ..	4	5	7
5 ..	..	..	57	77	3	7	38	14	1	..	Meadow fes-cue	12	..	..
6 ..	..	..	47	54	4	7	..	..	..	1	Mother white clover	3	43	34
7 ..	..	..	40	86	8	5	..	..	1	..	Kent wild white clover	3	40	9
8 ..	..	..	45	55	2	2	..	..	..	..	Pedigree white clover	3	51	39

In regard to the seed-mixture trials under sheep management, these were sown in the autumn of 1934 on rather wet, stiffish country that if neglected runs back to rushes, brown-top, and sweet vernal. The botanical composition of these mixtures is shown in Table IV, and it will be noted how dominance has been attained by perennial rye-grass - white-clover and how poorly most of the subordinate species have contributed to the sward. Here again it will be noted that strains in those species that are likely to be dominant is important. The white clover sown in the general base is a certified permanent-pasture strain, and it has performed remarkably well. At the time of the analysis (May) it will be noted that, on the whole, production is virtually equal to ground-cover excepting where no white clover was sown and a volunteer white clover of an apparently poor type appeared (Plot 11) and where the Kent wild white clover was sown (Plot 13). Here the actual production figure is considerably lower than the ground-cover figure.

Table IV.—Botanical Composition of Plots sown down to various Seed-mixtures, Autumn, 1934, and since utilized under Good Sheep and Cattle Management, Terrace Country, Massey Agricultural College.

Plot.	Base Seed-mixture.										Montgomery Red (3 lb.).		Additional Species.			
	Italian Rye-grass (5 lb.).		Perennial Rye-grass (25 lb.).		Akaroa Cocksfoot (6 lb.).		Dogstail (3 lb.).		White Clover (3 lb.).							
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.		Lb.	A.	B.
1	Tr.	Tr.	33	53	14	5	0	..	40	28	12	13	Base only	..	..	..
2	„	„	37	39	7	6	0	..	37	37	16	13	Italian	15	Tr.	Tr.
3	„	„	33	40	..	6	0	..	41	38	22	13	„	10	„	„
4	„	„	..	..	4	2	0	..	37	28	24	9	Station perennial	25	33	58
5	„	„	38	47	2	2	0	..	43	37	10	12	Timothy	6	3	1
6	„	„	42	38	4	2	1	..	31	42	21	17	Brown-top	2	..	2
7	„	„	46	60	3	1	0	..	36	33	13	5	Subterranean clover	4	0	0
8	„	„	35	37	4	9	0	..	39	41	20	12	Subterranean clover (Austral'n)	4	0	Tr
9	„	„	42	50	8	3	0	..	49	46	..	..	No red alsike	3	0	0
10	„	„	39	39	5	7	1	..	42	37	11	12	*Lotus major*	1	0	0
11	„	„	44	68	2	3	2	..	16	5	31	21	No white sown	..	..	..
12	„	„	35	36	5	2	0	..	..	..	17	8	Certified mother white	3	42	52
13	„	„	43	53	4	4	1	..	..	..	13	22	Kent white	3	36	20
14	„	„	34	22	6	3	0	..	..	..	12	13	Pedigree white	3	48	62
15	„	„	42	56	4	1	1	..	47	39	..	..	Broad red	3	4	3
16	„	„	36	52	..	..	1	..	40	36	8	7	Aberystwyth pasture cocksfoot	6	11	3
17	„	„	30	50	..	..	0	..	38	30	19	9	Aberystwyth dual cocksfoot	6	12	10

In the case of the certified "mother" seed and pedigree seed the production figure exceeds ground-cover figure, and this is a vital point when the carrying-capacity of the country comes to be considered. It will be noted that all the subsidiary additional species have fared badly, and even cocksfoot has been hardly worth while. The contribution from Montgomery red clover compared with broad red clover is significant (Plot 15), and the inclusion of Montgomery red clover would appear well worth while.

TRIALS AT WHANGAMOMONA.

Turning now to secondary-growth hill country sowings, the principle of the comparatively simple mixture holds good. In the course of the regrassing experiments in the control of secondary growth at Whangamomona over eighty species of grasses and clovers were sown, and in one mixture over fifty species were used. The outcome of that work was the drawing-up of a seed-mixture the species of which could be counted on one hand.

Some complex seed-mixtures that were sown and the resultant swards produced as a result of the seeding are shown in Table V. It will be noted that of the fifteen species used only three are contributing well after three years down, with volunteer species and weeds ranking higher in importance than the greater number of species sown. The danthonia in the mixture is in its early stages of aggressive development.

Table V.—Showing Composition of Swards sown out in various Mixtures for Secondary-growth Burns Three Years after sowing down, Whangamomona.

Mixtures (Pounds per Acre).	1.	2.	Ground-cover after Three Years.			
			Mixture 1.			Mixture 2.
Cocksfoot	8	..	2	1	1	4
Crested dogstail	4	6	12	9	10	12
Perennial rye-grass	6	4	2	3	2	3
Italian rye-grass	2	..	..	..	..	..
Poa pratensis	½	..	..	0·2	1	1
Brown-top	2	1	32	55	48	38
Danthonia	1	3	8	1	5	0·2
Paspalum	2	2	1	6	1	4
Chewing's fescue		..	2	1	..	0·5
White clover	1	2	4	2	10	1
Lotus major	½	1	14	37	6	34
Lotus hispidus	½	1	2	0·2	0·4	2
Red clover	1	2	..	..	1	1
Subterranean clover	½	1	..	1	1	4
Yarrow	½	⅛	1	0·2	1	1
Suckling clover	(Volunteer)		6	3	5	3
Yorkshire fog	,,		6	3	5	3
Catsear	,,		11	4	9	10
Other weeds	,,		5	5	16	11

Further evidence of the simple seed-mixture and its economy may be seen in the case of seed-mixtures for playing-greens, lawns, &c. In this connection mixtures were land down in 1932 at the Green-keeping Research Station at Hokowhitu, and these were analysed by the point and dissection methods in May, 1936, four years after sowing. The plots were managed for the whole of the period as a green in play, cutting being close and continuous. Manures and chemicals were applied to control weeds and clover and to maintain soil fertility at a standard that maintained equilibrium between the brown-top - Chewing's-fescue combination. The results are seen in Table VI.

Here it will be noted little or no improvement to the ultimate sward is secured by the lavish expenditure on seeds additional to that simple brown-top - Chewing's-fescue mixture, although it must be stated that crested dogstail and perennial rye-grass figured in the sward

for upwards of two to three years. The main point, however, is that simplicity follows the setting-up and maintenance of a stable environment. Control of the environment must be the aim of every grassland farmer, and it is for him to learn how best to create a stable environment that will produce the maximum quantity and quality of edible herbage. Land development in New Zealand by the State and by the individual farmer each year points clearer and clearer to the fact that the goal to grassland attainment is an environment that is conducive to the rise and stabilization of the simple perennial rye-grass - white-clover - dominate sward, aided and abetted may be by special-purpose pastures that are simple in fact and single in purpose.

Table VI.—Showing Details of Turf Analyses at the Green-keeping Research Area and comparing these with the Seed-mixtures sown.

(Sown March, 1932; analysed May, 1936. A = Point analysis; B = Percentage composition.)

Plot.	Base Mixture.				Additional Species with their Contribution to the Sward.			
	Brown-top (120 lb. per Acre).		Chewing's Fescue (240 lb. per Acre).					
	A.	B.	A.	B.		Lb.	A.	B.
1 ..	51	40	63	49	Base only ..	..	..	..
2 ..	55	47	54	47	*Poa pratensis* ..	240	2	2
3 ..	65	57	43	38	Crested dogstail ..	240	1	1
4 ..	64	57	41	36	Certified perennial rye-grass	240	..	..
5 ..	71	61	44	38	*Danthonia pilosa* ..	240	..	..
6 ..	70	50	54	39	Yarrow	40	9	7

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For assistance in the field-work in connection with this paper I am indebted to Messrs. E. A. Madden and P. D. Sears for botanical analyses, and to Messrs. J. W. Woodcock and W. B. Wards for field experimental data obtained at Marton.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 13th August, 1936, to 8th October, 1936, include the following of agricultural interest:—

No. 74927: Weed-killing apparatus; W. Jefferies. No. 74999: Drinking-trough; I. G. Frandi. No. 76009: Milk-bottle container; H. W. Van Buskirk and O. Beaulieu. No. 17620: Teat-cup; T. Shiels. No. 74721: Manure-distributor; T. H. Groves. No. 76349: Milking-apparatus; S. Turner, Ltd., A. F. Plint, G. H. Gascoigne, J. R. Knox, and J. A. Kingston. No. 74681: Flax-dressing; N. I. Gooder. No. 74879: Harrow; J. E. Holland. No. 75318: Animals, feeding; O. Gurtner and W. A. Meister. No. 75399: Shearing-machine fork; J. Davidson. No. 75556: Grain-treatment; Sunbred Ltd. No. 76076: Flax-dressing; cognate with No. 74681. No. 76540: Grain-separator; J. S. Robertson. No. 76460: Harrow; C. B. Idle. No. 76494: Spray-pump; S. E. and S. G. Holland. No. 76627: Cream and butter treatment; F. D. Fogarty and J. Black.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

SOME ASPECTS OF THE EXTREME SIMPLIFICATION OF PASTURE-SEED MIXTURES.

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A STUDY of grass-seed mixtures used during the past two hundred years reveals that there is relatively little new in the present-day trend towards the extreme simplification of such mixtures, and that during this period the pendulum has swung backwards and forwards. It is an accepted theory that extremes in anything are not desirable.

As an indication of how history repeats itself in this matter might be cited the advice tendered by various eminent authorities at different periods during the past 200 years. Mr. Arthur Young(1) about the year 1760 stated: "I may safely assert that a judicious farmer will by means of clover and rye-grass maintain nearly as many sheep on 300 acres as before were kept on a thousand."

The mixture recommended by Young was 10 lb. red clover, 8 lb. white clover, 6 lb. yellow clover, and 1 bushel of rye-grass, and incidentally the composition of this mixture would lead one to suppose that the importance of clovers to the pasture sward was fully appreciated at that early period. A little over a hundred years later mixtures containing up to twenty species were advocated, and as an instance of a mixture of the times might be quoted Elliot(2), who recommended for general pasture purposes—cocksfoot, 10 lb.; tall fescue, 3 lb.; crested dogstail, 2 lb.; hard fescue, 3 lb.; *Poa pratensis*, 2 lb.; golden oat grass, 3 lb.; burnet, 3 lb.; chicory, 1 lb.; parsley, 1 lb.; rib-grass, 1 lb.; yellow clover, 1 lb.; kidney vetch, 1 lb.; lucerne, 2 lb.; red clover, 2 lb.; white clover, 3 lb.; alsike clover, 1 lb.; yarrow, 1 lb.; and birdsfoot trefoil, 1 lb.: making a total of 39 lb. per acre. To-day, some sixty years later, we have grassland authorities recommending the sowing of one or at most two species. Stapleton(3) states that "A man starting on the poorest of poor soils would be doing nothing outrageous if he sowed wild white clover and nothing else. A man starting on fairly good soil, and where he expected white clover to volunteer freely, would be doing quite a sensible thing to put all his money into leafy perennial rye-grass and sow nothing else."

While apparently none of our New Zealand grassland workers have gone to such an extreme as Stapleton in the simplification of mixtures, there is nevertheless an indication that some are trending this way, and that species other than perennial rye-grass and white clover are regarded merely as incidentals to rather than necessary and desirable component parts of pastures. Such workers realize the shortcomings of a pure rye-grass - white-clover sward (although they do not realize them to the full), and to set off these weaknesses advocate the sowing of other paddocks with other pure sowings or selected species, such as cocksfoot, &c., dominant in a simple mixture. The theory behind this procedure is to provide variety and prolonged growth by having on the farm a series of paddocks practically of a one grass and clover association, each designed to cater for a particular season and a particular purpose.

If in the light of experience it has been found advisable to have dominant rye-grass, or dominant cocksfoot, or dominant any "other grass" paddocks, this objective surely can be achieved by merely

increasing the quantity of the required species in the mixture, and there would appear to be no real reason for the use of almost pure sowings on this account. It is contended by some that undue competition in a mixed pasture results in some species being entirely smothered, but it is suggested that this smothering is not nearly as great or serious as some would have us believe. Frequently one sees a pasture at a certain season of the year dominant with a certain grass, while at another period some other grass or grasses are dominant. Then again the following season conditions may be such that some individual grass that was thought not to have survived in the sward makes its presence felt on account of the peculiar conditions suiting its nature. It is quite conceivable, therefore, that in a mixed pasture certain grasses may be lying more or less dormant for long periods, merely waiting for a suitable opportunity, through unusual conditions, to become prominent. Thus a mixed pasture provides a measure of insurance against abnormal conditions that cannot be provided for in pure or nearly pure sowings. The variation that a mixed pasture provides for stock is perhaps a more important factor than it is generally given credit for. Levy(4) has stated, "Palatability, therefore, must be looked upon as a variable thing, and the palatability of a food will depend very largely on its relative mass in comparison to other foods." How then can we expect the palatability factor to be anything but unsatisfactory in a pasture 80 per cent. to 90 per cent. of which is composed of one variety of pasture-plant? The very unfavourable reports that are fairly common in Otago and Southland with regard to lack of palatability where certified rye-grass has been used can in most cases be traced back to pastures composed principally of rye-grass with very little of other grasses and perhaps clovers. This is only too obvious in those paddocks that have been sown down for seed-production where a pure sowing of rye-grass has been made. This may be an extreme illustration of the present-day simple mixtures, but nevertheless in these cases the degree of trouble lessens as grasses other than rye-grass and clover increase in the sward. On account of this lack of palatability in a pasture where rye-grass (or any other one grass) is dominant to a very marked degree, it is considered that in all probability 10 lb. to 15 lb. of certified rye-grass rather than 20 lb. to 25 lb. in a pasture mixture will develop into a general practice in the future, with other species being slightly increased to give the necessary seeding per acre. Probably if farmers in the far South sowed less certified rye-grass in the mixture than they have been encouraged to hitherto, much of the opposition to this class of seed would disappear. That there are authorities at Home holding this viewpoint is indicated by Cruickshank(5), who states: "Wild white clover along with a suitable mixture of perennial rye-grass and natural grasses makes a pasture beyond comparison of those of fifty years ago. The seeds sown were generally 30 lb. to 40 lb. perennial rye-grass, only occasionally a few natural grasses, and 4 lb. to 6 lb. of clover. Now, by reducing the perennial rye-grass to 14 lb. to 16 lb. and adding a proportion of natural grasses and 1 lb. of wild white clover, a marvellous change has been brought about." The greatest drawback, however, to the

sowing of simple mixtures in various paddocks for various purposes, and one that to my mind rules the system right out as far as its practical application is concerned, is in the high efficiency of pasture-management that is necessary to obtain successful results. Farming efficiency on even our best-managed farms does not stand at a very high figure. Wilkins(6) in a recent book stated that, "American agriculture is only 11 per cent. efficient judged on the scale of most efficient methods, while the co-efficient of most European countries would be below 30 per cent." Granted that our most efficient grassland farmers have no peer in any other part of the world, their standard of efficiency would possibly be well below 50 per cent. This knowledge that farming efficiency throughout the world is relatively low is no reflection on the ability of the individual farmer, but is rather an indication of the many and varied adverse factors of Nature that he has to contend with in his farming practice. For instance, seasons are by no means constant: if they were farming efficiency would possibly be brought to a very high standard. If spring definitely started on a certain date with a certain temperature, and this was followed at regular intervals by regular rainfall, with certain known temperatures, all of which in turn would produce a known quantity of grass, grassland farming could be worked out to a very fine art, and it would be within the reach of every farmer to provide stock when and where it was required to deal with the growth, or conversely to grow the grass at certain times to suit the stock. In practice, however, growth and stock numbers frequently fail to bear the desired relationship one with another.

Throughout Otago and Southland, as well as in many other parts of New Zealand, there are on certain farms pastures resulting from more or less pure sowings, as well as pastures put down with very general mixtures, and during the past autumn a fairly extensive survey was made of such pastures to see just what the position was with regard to production. Unfortunately, no farms working on the "one paddock one pasture type" system are known to be in existence, so that no fair comparison could be made; nevertheless the following data in connection with some of the pastures rather prove the value of the mixed pasture under efficient pasture-management methods.

Titipua Pastures.—These pastures are recognized as some of the finest pastures in Southland, and definitely come under the heading of mixed pastures. The mixture sown is somewhat as follows, quantities per acre being varied in some of the minor details at times: Certified perennial rye-grass, 25 lb.; Italian rye-grass, 10 lb.; timothy, 3 lb.; cocksfoot, 5 lb.; *Poa pratensis*, 1 lb.; *Poa trivialis*, ¼ lb.; white clover, 3 lb.; Montgomery clover, 1 lb.; yarrow, 1 oz.: total, 48¼ lb.

Most of the paddocks are dominantly rye-grass and white clover, but there exists in the sward in varying quantities cocksfoot, *Poa pratensis*, timothy, brown-top, red clover, dogstail, fog, yarrow, *Poa trivialis*, and hydrocotyle. Incidentally, it is intended to increase the timothy sown in this mixture. These pastures are mixed pastures, they have a high carrying-capacity, and fat lambs are got away with despatch. After seeing these pastures one is tempted to suggest that a

small quantity of brown-top should be included in all mixtures where sheep are grazed and where fat-lamb production is practised. It would be surprising to learn that Mr. Phillips's pastures at Marton, where over nine ewes to the acre are carried, are free of brown-top.

Winton Experimental Farm.—A five-year-old paddock that fattened nine lambs per acre off their mothers this season is principally a rye-grass-white-clover sward, but has also dogstail, timothy, cocksfoot, and red clover present in fair quantities.

Bowmar Bros., Gore, who are recognized in the district as very good farmers and whose production-figures are high, sow (in pounds per acre): certified perennial rye-grass, 30; Italian rye-grass, 5; certified cocksfoot, 10; dogstail, 2; white clover, 2; Montgomery red clover, 2; total, 51. The existing sward is roughly 50 per cent. rye-grass, 30 per cent. white clover, 15 per cent. cocksfoot, 2 per cent. timothy, 3 per cent. fog, dogstail, and weeds.

D. Gunn, Winton, is considered to be a progressive farmer whose pastures as a whole are very mixed and whose production-figures are high. One of his best pastures is dominantly brown-top, rye-grass, white clover, and dogstail, with a fair amount of *Poa trivialis.*

W. J. Cowie, Centre Bush, sows only rye-grass 33 lb., white clover 3 lb. per acre. Pastures are dominantly rye-grass, white clover, but contain a good deal of dogstail and brown-top and traces of fog.

W. Young, Drummond, considers his best paddock to be dominantly rye-grass, white clover, and cocksfoot, with some timothy and brown-top. On this paddock the cocksfoot is outstandingly good. This farmer sows (in pounds per acre): perennial rye-grass, 15; Italian rye-grass, 5; meadow fescue, 10; timothy, 4; cocksfoot, 4; white clover, 2; alsike, 2; dogstail, 1; red clover, 2: total, 45.

The position with regard to North Island pastures generally is known to be somewhat the same, production (and general satisfaction) being greater where a mixed pasture of good grasses exists. The one outstanding farm in Taranaki, where during the past season the production was almost 350 lb. of butterfat per acre, has pastures of a very mixed nature. In 1930, when production on this farm stood at 300 lb. per acre, the best paddock, when point-analysed, gave the following results (figures being hits recorded): perennial rye-grass, 26·00; white clover, 17·25; cocksfoot, 5·50; dogstail, 2·50; *Poa trivialis,* 1·50; red clover, 0·25; *Poa pratensis,* 25·00; suckling clover, 0·25; *Lotus major,* 0·25; Yorkshire fog, 4·75; foxtail, 6·25; sweet vernal, 15·50. In the case of this pasture rye-grass and white clover represented 36 per cent. of the sward, and it is quite an open question whether any great increase in this figure would be any advantage.

All the pastures quoted, and they are just typical of hundreds of others, can be safely said to be mixed in character, and have been evolved under systems of management of a practical nature apparently suiting the conditions as they exist, and returning to the farmers concerned profitable and apparently satisfactory returns. Are these farmers to throw away the very real "substance" of the mixed pasture for the "shadow" of a system of grassland farming that is far from convincing, has not yet been proved, and, to the minds of many, lacks practical application.

In conclusion it should be made clear that the statements herein do not cover country where, owing to various factors, the establishment of a mixed pasture may prove difficult and unsatisfactory. It is recognized that there exist in New Zealand tracts of country that are suitable for only one or two species, and where these conditions exist such pure species or simple mixtures must be relied on almost in their entirety.

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NOTES ON THE ARSENICAL POISONING OF LIVE-STOCK.

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The loss of stock through poisoning is a matter of considerable economic importance, and personal experience indicates that losses due to arsenical poisoning are by no means as uncommon in New Zealand as they might be.

Arsenic.

Arsenic belongs to the class of mineral or inorganic poisons, and has a wide occurrence in Nature, the chief sources being the yellow sulphides —*e.g.*, arsenical pyrites, a double sulphide of iron and arsenic.

Arsenious oxide, AS_4O_6, erroneously termed "arsenious acid" and commonly known as "white arsenic," or, in the trade, just "arsenic," is obtained by roasting certain arsenical ores. With its salts, this is the commonest form of arsenic. Arsenious oxide is sparingly soluble in water, but the alkali salts, together with the alkali thio-arsenites, in which oxygen is in part replaced by sulphur, are readily soluble.

Sources of Arsenic on the Farm.

The most common source of arsenic is probably the various dipping powders, pastes, and fluids used for the purpose of destroying ticks and lice in sheep and cattle. The majority of these preparations contain arsenic as their active ingredient, generally in the soluble form of sodium arsenite. According to Lander such "dips usually contain about 20 per cent. of soluble arsenic and 3 per cent. of insoluble arsenious sulphide, which is held to exercise a protective effect during the intervals between dipping. After solution for use the strength of soluble arsenic lies between 0·25 per cent. and 0·5 per cent."

Arsenic is used in some remedies for the treatment of foot-rot in sheep, and sometimes in solutions used in baths for the prevention and treatment of foot-rot.

In various weed-killers, solutions of sodium arsenite have been used.

Arsenic is also used in vermin poisons, in some preparations used for spraying trees, and in dressings for seeds—*e.g.*, wheat.

In medicinal doses arsenic is a tonic and alterative. It stimulates the gastric mucosa, improves digestion, and increases the appetite. It diminishes oxidation and increases the formation of fat. In horses, especially, it gives a certain plumpness and sleekness to the skin. For this latter reason arsenic is frequently administered to horses by grooms, trainers, &c. It is a common ingredient of various condition powders which are in great demand at times.

Arsenical sheep-dipping fluids are used for the destruction of fly larvæ on manure, &c., especially in the vicinity of stables in towns.

The Toxicity of Arsenic.

The arsenites are the most toxic of the ordinary arsenical preparations. Coarsely powdered white arsenic, which is sparingly soluble, is much less toxic than the readily soluble sodium and potassium salts: it is recorded that 270 grains of coarsely powdered white arsenic failed to kill a dog, but $\frac{9}{10}$ grain of potassium arsenite and $2\frac{1}{4}$ grains sodium arsenite proved fatal when given by the mouth. According to Kaufmann, 45 to 60 grains of the dissolved oxide will kill a horse, whereas 675 grains of the solid is required.

In solution, and particularly in the form of the alkali salts, and in very fine division the arsenious compounds are most readily absorbed and most toxic. The approximate lethal doses in grains of arsenious oxide (in the form of sodium arsenite) are—horse, 30 to 45; cow, 30 to 60; sheep, 6 to 10; dog, 5.

Method of Absorption of Arsenic.

The location of the absorption of a poison has a distinct bearing on the degree of its effect. Absorption may take place by any portion of the natural food tract, through the skin, or by the respiratory tract.

By the Digestive Tract.—The food tract is the most usual place for absorption to take place, chiefly through the stomach and intestine, on account of the more delicate lining membrane of these parts.

The absorption of dissolved arsenic through the mucous membrane of the digestive tract is very rapid, but, unlike the effect of corrosive poisons, there is a definite latent period before the effects of arsenic are apparent. Access to arsenic, in order that absorption may take place in this way, is through the contamination of food or water, or possibly from the surface of the skin in the case of animals licking themselves after spraying or dipping.

Arsenical poisoning of sheep has been known to follow the ingestion of pasture which has been contaminated by the drippings from the fleece after dipping. Clough records "A mysterious case of arsenical poisoning in bullocks was explained by the fact that the animals had grazed on long grass in a field into which sheep had been turned out after having walked through a foot-bath containing arsenical dressing for foot-rot. Cattle have died from arsenical poisoning after drinking from a trough which has contained an arsenical dressing for foot-rot in sheep." This year in Dunedin a case of arsenical poisoning in horses resulted from contaminated drinking-water. The details of this case are of practical interest.

Out of four horses, A, B, C, and D, three worked on a certain Saturday morning and partook of their midday meal after return to the stable. All refused their evening meal, but no special notice was taken of this, as a new line of chaff was commenced that day. About 3 a.m. on the Sunday morning the yard-man heard unusual sounds from the stables. On rising to investigate he found two of the horses (A and B), both aged geldings, uneasy and in some pain ; one of them was down and groaning. Subsequently both horses became very dull and depressed, with a marked increase in respirations. Exhaustion followed rapidly, and A collapsed and died at 5 a.m. The horse B followed the same course at noon, but became delirious before death.

About this time another eight-year-old black gelding C was seriously ill. This horse I saw, and it was obvious he was not likely to recover. When seen he was standing in his stall in an alarmed state, temperature 104 (normal temperature of a horse 100), increased respiratory action, conjunctival mucous membranes deeply injected, no pulse at all, heart-beats approximately 80 per minute, shallow beats with arrhythmia, no salivation, no diarrhœa or marked colic. The fourth horse, D, was also ill, but not to the same degree, the most marked symptoms being dullness, inappetence, temperature 101·6, cardiac arrhythmia, and a thready pulse.

The sudden onset of illness of such an alarming character, and the fact that four horses were involved, indicated poisoning. Experience suggested arsenical poisoning, and on this tentative diagnosis the horses C and D received approprate treatment. C lasted without any marked change until the Tuesday morning, when he collapsed and died. D eventually recovered. The first two horses to die were subjected to post-mortem examination, and both presented very much the same picture. The most pronounced lesion was intense gastritis, slight enteritis of a patchy nature, most marked in the horse A in the cæcum, petechial hæmorrhages in the pericardium and visceral peritoneum, passive congestion of the lungs. Both horses had a post-mortem rupture of the diaphragm.

Samples of the food and water and the stomach contents of the first two horses to die were retained for chemical analysis. Mr. L. H. James, M.Sc., A.I.C., Government Analyst, Dunedin, reports as follows on the analyses of the samples :—

> The drinking-water (J/259) contains arsenic equivalent to 0·738 grams of arsenious oxide per litre (51·7 grains per gallon). I estimate the fatal dose of arsenic for a horse at from 30 grains upwards. The arsenic is not present in the water as arsenious oxide (or " white arsenic "), but is in solution as sodium arsenite. This is the form in which it occurs in sheep-dip. A small quantity of tar acids was also present in the drinking-water. This is also consistent with the presence of sheep-dip in the water.
>
> The stomach contents (J/255 and J/257) both contain arsenic.
>
> The chaff (J/260) contains no sheep-dip and no " white arsenic."

An arsenical sheep-dip was in use in the stable for the purpose of spraying manure in order to destroy fly larvæ, a practice in use for some years past. The horses drank in the yard from a barrel, which held

about 33 gallons of water, and, if this was full at the time, at least ½ pint of sheep-dip must have got into it. Presumably at midday Saturday the horses took in 51·7 grains of arsenic with each gallon of water consumed. The use of an arsenical sheep-dip in and about a stable is a questionable procedure at any time, and, if it is necessary, this case illustrates the necessity for the exercise of absolute care.

In another case noted two good draught horses were lost from arsenical poisoning. Material, which originally had been taken from a tree-spraying machine, was wheeled in a barrow across a paddock; in doing this the pasture where the horses grazed was contaminated.

By the Skin.—The normal secretion of the skin is fatty. An alkali saponifies a fat and emulsifies it, thus alkaline solutions of arsenic, such as are used in dips, increase the risk of penetration if left in contact with the skin too long, and especially if the solutions are too strong. Arsenic from a sheep-dip is absorbed by intact normal skin only in relatively small amounts. The well-known proprietary dips are of standard uniform strength, are in universal use, and every safeguard is taken against any danger attendant upon their use, providing strict attention is paid to the directions and the method of procedure is carried out judiciously and correctly in accordance with the makers' instructions. Nevertheless, if animals be dipped or sprayed with arsenical solutions that are too strong, or if they are dipped or sprayed when hot through being driven, &c., poisoning through the absorption of arsenic by the skin may occur.

Clough records the following case in England: "A farmer accidentally prepared too concentrated a solution of a liquid arsenical sheep-dip and applied it to the necks of twenty-eight cattle, ten of which died of acute arsenical poisoning. Chemical analysis of the skin and viscera indicated that the poison had been absorbed through the skin."

In 1929 in Otago eighteen pedigree cattle were sprayed with a solution of a well-known arsenical-paste sheep-dip, and this in spite of the fact that the manufacturer's instructions clearly stated on the label on the drum that on no account must horses, cattle, or dogs be sprayed or dipped with the paste. Incidentally the directions on the drum stated that 1 lb. of the paste should be mixed with 10 gallons of water. Instead of this quantity of paste being weighed, a flat piece of board was used to ladle out an indefinite quantity for mixing with the water. In fact, there was glaring carelessness throughout. All the animals concerned exhibited symptoms of arsenical poisoning, and three died. In this case absorption, in the main, was through the skin, a definite eruption was noted, particularly inside the thighs and round the scrotum and mammary gland. The words "in the main" are used because there is a possibility of ingestion, as cattle, like dogs, lick themselves, and, to a lesser degree, horses also.

In 1935 in a further case recorded in Otago by Mr. A. L. Thompson, M.R.C.V.S., four horses were involved. They had been dressed for lice with a solution of sheep-dip, although warnings have been issued from time to time in this *Journal* that arsenical sheep-dipping solutions should not be used for this purpose. All the horses exhibited symptoms of acute arsenical poisoning, and one horse died.

Absorption of arsenic from the broken skin is naturally far more rapid than from the intact surface. In regard to this Lander states,

"The difference is well illustrated by Kaufmann's figures for the toxic doses of powdered arsenious oxide for sheep, which are by the mouth 75 grains, and by application to a wound 3 grains."

Symptoms of Arsenical Poisoning.

Firstly arsenic is an acute irritant poison producing in all animals gastro-enteritis. In general, in acute poisoning there is loss of appetite, thirst, and severe colicky pains, irregular heart action, with an imperceptible or weak irregular thready pulse, visible mucous membranes are highly injected, acute depression, exhaustion, death occurring in a variable period, with symptoms of coma or with tetanic spasms.

Apart from extreme debility, there may be noted paralysis of the hind extremities, coldness of the ears, and trembling, stupor, and convulsions. In prolonged cases giddiness, muscular tremors, colic, and coldness are prominent. In cases of absorption through the skin there is a scalded appearance, with a purply red eruption, later with sloughing in patches, similar to some extent to arsenical eruption in man.

Treatment.

A first objective is expulsion by oily purgatives—*e.g.*, raw linseed oil in the horse and ox. As specified antidotes, calcined magnesia and freshly precipitated ferric hydroxide are used. In dealing with an emergency case of arsenical poisoning in the ox, horse, or sheep, one may precipitate tincture of iron perchloride with soda carbonate, filter through a handkerchief and give *ad lib* in warm water at intervals of ten minutes. Demulcents, such as oatmeal or starch gruel, linseed tea, milk and eggs, or milk alone, should be given. Copious warm enemata promote peristalsis and excretion. Any skin application such as dip must be washed off, preferably by soapy water. Hypodermic injection of morphia is desirable if there is much pain.

References.

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An endeavour to make better provision of feed is indicated in the fact that the sales of lucerne culture by the Department have been record ones and sufficient to treat the seed required for the sowing of approximately 8,000 acres. After making allowance for the area of previously established lucerne which goes out of production annually on account of its age, &c., the sales of lucerne culture point to an increase in the total Dominion acreage of lucerne. At the same time, the apparent increase at best is only a few thousand acres, and, while welcome as a continuation of the steady increase in the Dominion acreage of lucerne which has been going on for several years, it is much less than the intrinsic merits of the crop justify. Our knowledge of the requirements of lucerne and of its culture under local conditions has become sufficient to enable the failures with the crop that occurred fairly often in the past to be avoided, provided advantage is taken of the conclusions which have been drawn from accumulated field experience and from field trials.—*Annual Report, Director-General of Agriculture.*

TOP-DRESSING IN SHEEP-FARMING ON ROLLING COUNTRY IN THE HASTINGS DISTRICT.

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OFFICIAL figures showing the amount of artificial fertilizer delivered at officered railway-stations in Hawke's Bay over the period 1928–29 to 1935–36 are as follows :—

Year.	Tons.	Decrease relative to 1928.	Increase or Decrease relative to 1931–32.
		Per Cent.	Per Cent.
1928–29	18,752	..	..
1929–30	13,677	27	..
1930–31	13,889	26	..
1931–32	13,280	29	..
1932–33	11,899	36	10 (decrease).
1933–34	13,809	26	4 (increase).
1934–35	18,757	..	41 (increase).
1935–36	16,405	..	23 (increase).

These figures indicate a steady decrease in the amount of fertilizer brought into Hawke's Bay from the peak year, 1928–29 to 1932–33, since when there has been a steady increase up to the present time. It appears, therefore, that the amount of fertilizer brought into Hawke's Bay has strictly coincided with the prosperity of the community. That this is so is frequently borne out by farmers, who say that they usually top-dress but have not done so during the slump, although they have recommenced this season.

The indications from the farm-management survey at present being conducted by the Department of Agriculture in the area under discussion are that, in general, the amount of top-dressing done is relatively small. Of the total of about ninety farms so far visited, only one farm has been seen where the total area of the holding is top-dressed each year, although most farmers interviewed agree that top-dressing gives good results and pays for its application. About 10 per cent. of the farmers visited do no top-dressing at all, while farms, on similar country around them, are at least receiving a certain amount. The reason advanced in nine cases out of ten is not that manures do not give a response and pay for their application but that the farmer is not in a financially sound enough position to expend money in this direction.

It seems that, with the increasing dissatisfaction with the rape crops being obtained, due to attack from pests, there is a trend to the top-dressing of grassland and the growing of subterranean clover, so that an increasing percentage of lambs may be turned away fat off the mothers. Many instances are on record where this has already taken place.

In general, in the area under review, superphosphate is the only fertilizer applied. On some of the higher rainfall country basic slag is being used, but not commonly. Potash and nitrogen are practically never used, and lime is used by about 20 per cent. of the farmers.

The tendency is, on the lighter land and under rainfall conditions of over 35 in., to apply anything between 1 cwt. and 3 cwt. of fertilizer per acre. Fertilizers are nearly always applied in the autumn, usually about April.

Method of Application.

Large areas of the district under discussion are suitable for top-dressing through a manure-broadcaster, either drawn by horses or by tractor. Much of the country, however, is of such a nature that top-dressing must be done by hand. The average area which can be top-dressed by a distributor, on country over which the distributor can pass without much trouble, is 10 acres to 12 acres per day. Areas top-dressed by hand vary between 7 acres and 10 acres per man per day, depending on the rate at which the fertilizers is being applied and the nature of the country to be traversed.

Experiences and Comparisons on Selected Farms.

EXAMPLE 1

Farm A: Top-dressed (3 cwt. per acre on 350 acres); Farm B: Untop-dressed.

Rainfall: Approximately 50 in. annually, with approximately 125 rainy days.

Farm A.—This property, 1,143 acres in area, was taken up eight years ago, and top-dressing was commenced in the following year. The place was largely covered with fern and scrub, which has had to be cleared and ploughed before good grasses could be sown. In its untop-dressed state this type of country does not hold good grasses and clovers for more than three or four years, when the pasture becomes invaded with brown-top, fern, and scrub. When the property was first taken over it carried 500 sheep. In 1928–29, when top-dressing was commenced, it carried 800 sheep, 500 of which were breeding-ewes, the balance hoggets. The average lambing percentage at this time was 55 per cent. to 60 per cent. To-day, with the clearing and sowing-down and subdivision, 1,100 breeding-ewes are being carried, with an average lambing from the ewes of 85 per cent. to 90 per cent. So far no change-over from breeding to fattening has taken place, as stock numbers are steadily increasing and the surplus ewe lambs are required each year to supplement the ewe flock. It is anticipated from results so far obtained that three ewes per acre will be carried and surplus lambs fattened. It has been calculated that, over the eight-year period, an increase of 3 lb. of wool per head has been obtained, and the quality greatly improved.

Pastures which have been down for six or seven years show no deterioration, the paddocks tending to improve rather than to degenerate, as was the case before top-dressing was commenced. Increased consolidation and fertility owing to higher stock numbers contribute to this. Manure always is sown with the seed to give the young plants a good start—a thing which one feels is not common enough in Hawke's Bay, where a fairly late sowing is usually made after rape.

Farm B.—This farm, 1,595 acres in area, is probably better land than Farm A, although it is harder to work in that much of the country is unploughable and would have to be top-dressed by hand. This property, on the 1,600 acres, was carrying in 1935 1,070 sheep, a decrease steadily taking place after 1925, when 1,400 sheep were carried. Lambing percentages range from 70 per cent. to 80 per cent. Wool clip averages 7 lb. per head. No top-dressing is done at all.

Comparison.—Farm A is carrying 1,600 sheep on 1,143 acres, showing an advance in eight years of 1,100 sheep. Practically the whole of these sheep are being carried on the top-dressed portion of the farm, which represents only 350 acres out of a total of 1,100, or approximately one-third.

Farm B is carrying 1,070 sheep on 1,595 acres, and stock numbers have, over a ten-year period, remained approximately constant, with a slight tendency to decrease. Farm A has an average lambing percentage of 85 per cent. to 90 per cent.; farm B, one of 70 per cent. to 80 per cent. Farm A clips 9 lb. of wool per head; farm B, 7 lb.

EXAMPLE 2.

Farm A: Top-dressed (1¼ cwt. per acre on 800 acres). Farm B: Untop-dressed.

Rainfall: 35 in. annually, with an average of 112 to 125 rainy days.

In this case, no farm can be found that is sufficiently like it in size and condition to warrant any comparison being made, but country essentially similar to that which is being top-dressed is carrying half to three-quarters of a sheep per acre at the present time.

On this property, which is 2,439 acres in area, having 1,300 acres of flat land, previous to the top-dressing, subdivision, and the planting of shelter-belts all wet sheep were carried entirely on the hill country, the flats carrying wethers and hoggets only. The flats were subdivided into three sections—640 acres, 400 acres, and 250 acres in area. This total area has since been further subdivided into fourteen paddocks. On 150 acres of the 640-acre section only 200 wethers were carried, and in another block, 250 acres in extent, 260 very late lambing and empty ewes were run from January to May. This section was ploughed out of gorse and scrub eighteen years ago, and little subdivision and no top-dressing has been done. In all the other paddocks of the flat land, which have been reduced in size by fencing and sheltered as well as top-dressed, three to five ewes can be run from July to January and cattle in the spring, and cattle and ewes while the rams are out, from the beginning of March to the end of April. From the end of April to the end of July the paddocks are grazed with hoggets.

On the farm as a whole, before the improvements mentioned took place, 1,000 ewes and 1,500 dry sheep, made up of 1,000 hoggets and 500 wethers, were carried. This has increased to 3,100 breeding-ewes, 100 wether lambs, 1,120 hoggets, and 85 rams. Cattle numbers have greatly increased. The farmer has therefore increased the carrying of the whole farm by seven-eighths of a breeding-ewe to the acre plus dry sheep and cattle.

In both quality and quantity the wool has shown a steady improvement.

EXAMPLE 3.

Farm A: Top-dressed (3 cwt. per acre on 200 acres); Farm B: Untop-dressed.

Rainfall: 60 in. annually, with between 125 and 150 rainy days.

The two properties chosen in this district are on exactly the same type of country, of almost the same area, and with the similar areas of ploughable land.

Farm A.—This property has been top-dressed fairly heavily and consistently for the last six years. Farm B has had some top-dressing, but very little. Farm A was taken up in 1926, and was then carrying 600 to 700 ewes, and the balance, making a total of 1,466, were hoggets and dry ewes. At the commencement of top-dressing in 1930, 1,000 ewes were carried, and no dry sheep except twenty or thirty killers and rams. The change-over from breeding to buying was made as soon as the property was taken over in 1926. Up to and including 1930, an average of 40 per cent. of lambs went away fat off the mothers, the balance being sold as stores. To-day, 75 per cent. of the lambs go away fat off the mothers, 60 per cent. going in the first cut, the balance being fattened on grass, no rape being grown. In addition to the lambs which are bred on the place and fattened, between 400 and 500 stores are bought in and fattened. To-day the property is carrying approximately 1,400 ewes and fattening lambs on the 682 acres. Old ewes are sold in lamb, and all cattle are sold fat.

There is also a marked difference—which, however, cannot be indicated definitely—in the way that the ewes come out of the wool: nearly every sheep shorn is prime enough for killing off the shears. Whereas lambs previously were not turned off the place until the end of December the first draft now goes away at the end of November. Ewes coming from nearly anywhere on to this place seem to do well, coming through the winter to lambing in much better condition than was the case previously. This has been so noticeable that as the result of top-dressing it has been found possible on this farm to discontinue the growing of swedes to carry ewes through the winter.

Farm B, which has not been top-dressed. This property was taken over in 1925 by the present owner, and carried, on the 625 acres, 1,100 sheep, and this number has remained approximately constant until this year, when it is again 1,100 sheep—800 breeding-ewes, 260 hoggets, 40 killers, rams, &c. The Southdown is not used at all, and wether lambs are not fattened, but are sold as stores. Old ewes at five years old and cull two-tooths are sold as breeding-ewes. If one breeding-ewe is estimated as the equivalent of two dry sheep the farm carries approximately 950 breeding-ewes. The amount of wool clipped on this place, where there is scope for the breeding and selection of well-woolled sheep, was 9·5 lb. per head. The lambing percentage is 95 to 100. It must be remembered that only the Romney ram is being used, and there is a percentage of two-tooths in the flock.

Comparison.—Farm A has increased from 1,400 sheep, 600 to 700 of which were breeding-ewes, to 1,000 ewes in 1930, when top-dressing was commenced, to 1,400 at the present time. Farm B has remained stationary at 1,100 sheep, say, equivalent to 950 breeding-ewes, since 1925.

Farm A has an average lambing percentage of 105 to 114. Farm B has an average lambing percentage of 95 to 100, one-quarter of the flock being two-tooths, and the Romney instead of the Southdown ram being used.

Farm A clipped 11·3 lb. of wool this year. Farm B clipped 9·5 lb. Farm A sells all fats; Farm B sells all stores.

EXAMPLE 4.

Farm A: Top-dressed (1 cwt. of superphosphate per acre every other year on 200 acres); Farm B: Untop-dressed.

Rainfall: 35 in. to 40 in., with 125 rainy days.

Farm A.—This property is 443 acres in extent, and was taken over by the present owner in 1921, when it carried 370 sheep, 90 of which were hoggets. When top-dressing was commenced eight or nine years ago, 450 ewes and 100 ewe hoggets were being carried, and swedes and rape grown for winter and fattening feeds respectively, which meant the upkeep of a team and implements. The change-over from the policy of breeding to buying was made simultaneously with the commencement of top-dressing. To-day the property is carrying over 800 ewes. Since the top-dressing of the farm the lambing percentage has increased from 85 to 110, the 85 per cent. being the average lambing obtained from the Romney flock before the change-over to the Southdown was made and top-dressing was applied. It is maintained by the owner that since top-dressing he has increased by 3 lb. the weight of wool per fleece.

The year the change-over to the Southdown ram was made only 20 per cent. of lambs went away off the mother, and this was usual up to that time. In the autumn of that year fertilizer was applied, and the following season 70 per cent. of the lambs went away off the mothers, increasing up to 90 per cent. in the following year. Since that time practically every lamb on the place goes away fat off the mother.

The wool clip averages 8 lb. to 8½ lb. per fleece. When rape was grown as a fattener, lambs never went away until February or March, but now all lambs are away before the end of January.

Farm B.—In 1922 this place carried through the winter 533 sheep on the 380 acres. The present number being carried is 674, 550 of which are ewes and 120 hoggets. There has, therefore, been an advance in total sheep numbers of 123 in the last fourteen years. The wool clipped per fleece on this property is 6 lb. to 7 lb. The lambing percentage is 80 to 85, the Romney ram being used, and there being about one-fifth of the flock two-tooths.

Comparison.—Farm A has shown an advance of 546 sheep on an original number of 370, together with a change-over to fattening, over a fifteen-year period.

Farm B over the same period has shown an advance of 123 sheep over an original 533, unaccompanied by any change to fattening.

Farm A clips 8 lb. to 8½ lb. per head off old sheep. Farm B clips 6 lb. to 7 lb. per head off a mixed flock.

Farm A has an average lambing of over 100 per cent., and lambs go away fat off the mothers. Farm B has an average lambing of 80 per cent. to 85 per cent., and no lambs are fattened.

Discussion.

The field experience described above is not submitted as definite proof that top-dressing pays in all the areas mentioned above, although the figures certainly suggest that this is the case. Neither are the results described to be interpreted necessarily as a condemnation of the practice of those farmers who do not top-dress, for many farmers who took over places in high-price periods were not in the position during the slump years to spend money on fertilizers.

The data presented tend to show that, as a result of top-dressing—

(1) Stock numbers, on all places quoted above as being top-dressed, have increased :

(2) In most cases this increase has been, or will be, accompanied by a change-over from the selling of the surplus stock as stores to the selling as fats :

(3) That lambing percentages tend to increase :

(4) That more wool per fleece, of a better quality, is grown :

(5) That good pastures can be maintained in places where good pastures were never maintained before.

It is rather noticeable that all places chosen were in areas with a rainfall of 35 in. or more. The results cited above were not the results of top-dressing alone ; they were the results of a combination of factors of which top-dressing was one. In order that maximum results may be obtained from the application of fertilizer, the value of efficient management of pastures and stock, subdivision, and shelter must be appreciated, and, in the cases where good results have been obtained from top-dressing, these matters have received due attention.

GOOSEBERRY CULTURE.

H. F. Frost, Orchard Instructor, Masterton.

The gooseberry is probably the most extensively planted berry-fruit in the Dominion. While it does not usually bring the attractive prices realized by the other berries, the ease of production, harvesting, &c., makes it quite a profitable crop, possibly more definitely so over a period than the other berry-fruits.

Gooseberries thrive under most conditions in the cooler districts, but prefer a moderately light, well-drained loam, although they have been observed doing well under heavy-loam conditions. They do not thrive where soil acidity is present. Consequently, a fairly heavy liming is desirable prior to planting, and subsequently at intervals. It is necessary to clean the land thoroughly of weeds prior to planting, and for this purpose, after the land has been deeply ploughed or dug and worked-down, a crop of potatoes or a lupin cover crop should be grown the season before the bushes are to be planted out.

Varieties.

The selection of varieties is of some importance; early maturing is important, owing to the practice of marketing the major portion of the crop in the green state. Early marketing is necessary owing to the falling-off of the public demand when the raspberry and strawberry crops come forward in bulk. Of the varieties in commercial plantings, Farmers' Glory is the best and most consistent cropper. Roaring Lion is also a good variety. Of the others, Gregory, Lancashire Lad, Trumpeter, Crown Bob, Winham's Industry, and May Duke are the best known. There are a number of new varieties under test overseas, and some of these may prove to be suitable for our purposes.

FIG. 1. (*a*) ORIGINAL CUTTING; (*b*) THE CUTTING DISBUDDED; (*c*) PLACED IN TRENCH; (*d*) WHEN FILLING TRENCH, EARTH SHOULD BE FIRMLY TRODDEN IN AT THIS STAGE.

Propagation.

The usual method of propagation is by cuttings. These should be selected from the more vigorous and best-cropping bushes. They should be cut into lengths of 10 in. to 12 in.; all the lower buds should be removed, and three or four buds left at the top. The cuttings should then be placed in a selected bed of medium loam by digging a 6 in. to 8 in. trench, and then placing the cuttings a few inches apart. The soil should then be filled and trodden in firmly; it may be necessary to inspect these from time to time to see that frost action has not loosened the soil about them; if so, this should have attention, and the ground should be trodden in firmly again. During the ensuing summer the land about the cuttings should receive frequent hoeings. In the autumn plant out in prepared soil, about 1 ft. apart, and cut back the main branches to a couple of buds. Commercial growers usually use the two-year-old plants for planting out permanently.

Planting.

Generally speaking, 6 ft. by 6 ft. apart is considered the most suitable distance to plant. Various considerations enter into this question, such as the type of growth of the variety, the method of cultivation contemplated—viz., horse or tractor—and, perhaps the most important

of all, whether green crops are to be grown for ploughing-in purposes. Should this be intended a greater margin, say, 7 ft. by 7 ft., would be advantageous. If spade and hoe work only are to be used, the 6 ft. by 6 ft. planting will be found to be sufficient. Care should, however, be exercised when planting to see, as far as practicable, that root-injury is avoided ; broken roots should be pruned back to sound healthy wood.

Pruning.

After the first year's growth, four or five of the strongest shoots should be selected as the main branches. It is necessary to cut these back two-thirds of their growth, so that a strong, well-balanced, robust

FIG. 2. INITIAL FRAMEWORK DEVELOPED—SUBDIVISION OF THE LEADERS MAY BE INSTITUTED AT THIS STAGE WHERE NECESSARY.

bush may be developed. The balance of the shoots should be completely removed or cut back to encourage the development of fruiting-spurs. It must always be borne in mind that the best fruits are grown on the previous year's growth, and at subsequent pruning this aspect must be kept in view

Crowding the centre of the bush with too many leaders should be avoided. Light and air are essential. To prevent crowding the centre a system of completely heeling out superfluous shoots may be employed. This is accomplished by twisting (not cutting) out the undesirable shoot at the base. This method has the advantage of removing basal buds, and it eliminates the risk of the development of wood suckers.

The number of leaders may be increased as the size of the bush increases; these should be well furnished with spurs and fruiting-laterals. Cut back annually to keep the bush vigorous and to ensure the development of new growths, which in the following season produce the best class of fruit. Cut out all crossgrowths and rank shoots; these latter rarely produce fruit-buds.

By the time the plant settles down to annual cropping, a proportion of the leaders outlive their usefulness. Provision for their replacement should not be lost sight of by the pruner. There is a tendency for the bushes to develop a spreading habit. This may be obviated by the gradual removal of the lowest branches, and by cutting to an upright lateral or inside bud of a strong annual shoot. The chief objective in pruning operations is to keep the plants in normal vigour, and, as there is considerable variation in the response of the different varieties to treatment, both as regards cropping and growth, it is advisable to take careful note of the results of previous pruning and cultural operations. This assists in a large measure in deciding the particular future treatment most suitable for each variety.

Cultivation.

The land should be kept in good tilth, especially during the crop-development period; the conservation of moisture is all-important, and to ensure this regular hoeings and shallow cultivation should be given, continuing until possible damage to crop prevents further work of this nature.

After harvesting the crop merely sufficient cultural work to keep weeds under control should be done. Excessive cultivation in the late summer is inadvisable, as it may be the means of encouraging sappy growth late in the season. The fibrous surface-roots should be injured as little as possible by digging.

Manuring.

Gooseberries readily respond to applications of farmyard and other organic manures. Owing to a general shortage of this material, green cover-crops are being used to supply that need. Mineral fertilizers applied in the spring are also extensively used with satisfactory results. The following mixture is suggested for application under average conditions: Sulphate of ammonia, ½ cwt.; superphosphate, 2 cwt.; sulphate of potash, 2 cwt. per acre. The quantities and proportions of the fertilizers should be varied in accordance with the vigour of the bushes. A fact of guidance to small growers is that about 2 oz. of the above mixture to the square yard would be required. Potash appears to be one of the most important fertilizers for this crop: it should be applied annually in one or other of its forms—the sulphate form for preference.

Soil acidity is to be avoided, and any tendency in this direction should be rectified by the application of 10 cwt. of carbonate of lime per acre in the spring every two or three years. A light dressing of nitrate of soda, just at fruit-set, well repays the expenditure.

Pests and Diseases.

The gooseberry is possibly less prone to attack by fungi than the majority of the small-fruits grown in this country.

We are particularly fortunate in being free from such a disease as the "American gooseberry mildew," and also from the saw-fly (*Nematus ribesci*), both of which do very considerable damage to this plant in the Northern Hemisphere.

Botrytis causes much loss to gooseberry-growers in the Dominion. This disease is sometimes confused with root-rots. It may be detected in an early stage of its development through the wilting of the foliage on individual branches. When observed these should be cut out at their base and the cut surface dressed with bitumen paint or with Bordeaux paste, which is composed of 1 lb. copper sulphate, 2 lb. hydrated lime, and 1½ gallons of water.

Should leaf-spot be of a severe nature, a spring application of Bordeaux mixture (5 lb. bluestone, 4 lb. lime, and 50 gallons of water) is desirable. This may be followed with advantage by an autumn application at the same dilution. The materials required to make a 4-gallon quantity of Bordeaux of 5–4–50 strength is as follows: Bluestone, 6½ oz.; hydrated lime, 5¼ oz.; and water, 4 gallons.

European gooseberry mildew (*Microsphaera grossulariae*) is held in check easily with a spring application of lime sulphur (poly-sulphide content 15 per cent. W/W) at the dilution of 1 part by volume to 15 parts of water, when the buds begin to swell. Later in the season, if necessary, apply lime sulphur 1–180 plus colloidal sulphur 2–100, and repeat if mildew is present.

Silver-leaf (*Stereum purpureum*) also attacks the gooseberry, and, when detected, the affected part should be cut out, and the treatment advised for botrytis applied. In the event of the disease having reached an advanced stage, it would be advisable to dig out the plant and destroy it.

A careful watch should be kept for the borer, which causes much damage if left unchecked. Its presence is easily detected through a wilting of the leaves. When observed, the affected twig should be cut out and destroyed. Control of this pest may be made more efficient by the removal of dead wood and stubs at the annual pruning, as these are the usual places about which the female deposits her eggs.

TARANAKI PASTURE COMPETITIONS, 1935–36.

A. G. Elliott, Instructor in Agriculture, New Plymouth.

The past season has been the most successful since the inauguration of the pasture classes, not only from the greatly increased scope of the competition by the provision of extra classes resulting in additional entries, but also in the focussing of attention on grassland problems as shown by the numbers of farmers who attended during judgings in each district. An indication of the increased interest taken by farmers generally is shown by the total entries, which were—1935–36, 308; 1934–35, 107; 1933–34, 115; 1932–33, 93; 1931–32, 102; 1930–31, 50.

While no district has withdrawn from the competition, five—namely, Rahotu, Cardiff, Mangaehu, Uruti, and Okau—have entered for the

first time. Of the total 308 entries, of which only three were ineligible for the second judging in autumn when they were cut for ensilage, thirty-seven were in the newly constituted improvement class and twenty-eight in the open or mixed-grazing class created this year. In connection with these new classes any entry judged the previous year, whether in the dairy or open class, is eligible for the improvement championship and the field may be harrowed and surface-sown or any form of surface cultivation may be practised, but the area must not be ploughed. Members of the Competitions Committee firmly believe that this is the most important class in the pasture section, tending as it does to bring about economical grassland improvement on every farm. The open class was inaugurated to bring in farms on which sheep are grazed either alone or with the dairy herd, and also to secure entries from farms where pigs are carried on the open-grazing system. This scheme of mixed stocking of pastures either in rotation or all on the area at once is becoming a definite practice and has much to recommend it.

Judging, which commenced in the middle of October and occupied about five weeks in the spring, was carried out exactly as last year, but it will be noticed that, as the season was backward and pastures had in many districts suffered badly from "poaching" during the winter, points were slightly lower than at the same time last year. Autumn judging started in the second week of March and was completed on 9th April, when the six top dairy entries and the three top open entries were rejudged on the one day. Just as the pastures were backward in most districts for the first judging, the opposite condition prevailed in the autumn, when, owing to the unusual flush of feed, many areas showed rank growth, indicating lack of control. Competition in both dairy and open classes was very keen, and it is noteworthy that Lepperton and Okato districts practically divided championship honours, with Ngaere also showing up prominently in the list of winners. After each judging, a complete list of points awarded every entry was left in the district, and these data are not published in full.

The year under review has been a most difficult one for the grassland farmer, as, although the usual amount of winter feed was saved, it proved insufficient in many districts as the unusually cold, wet conditions necessitated heavier feeding in July. Two important lessons to be learned from the season were—firstly, that one can never have too much feed in reserve, and, secondly, that shelter is of extreme importance. The value of the former was obvious to those who were unfortunately forced to purchase hay for the late winter and early spring, when pasture-growth was slow and the effect of shelter was marked, not only in the better condition of stock on sheltered farms, but also in the earlier growth seen on such protected fields. Certain districts are now fairly well furnished with hedges and shelter-belts, but there is still much to be done in this direction throughout the territory generally.

The following data obtained from information supplied by competitors are of great interest, enabling the reader to study the methods in practice on the farms under review.

Acreage of Paddocks.

The sizes of the fields entered were—3 acres, 34 fields; 4 acres, 51; 5 acres, 43; 6 acres, 36; 7 acres, 29; 8 acres, 21; 9 acres, 7; 10 o 15 acres, 43; 15 to 20 acres, 4.

Even with the open friable soils providing good drainage for the majority of pastures, subdivision can be overdone in this high-rainfall climate. Size of field must necessarily be governed not only by the number of stock carried but also by the ability of the farmer to feed out in such a way that winter "poaching," resulting in weed-invasion, is reduced to a minimum. Actual observation on the farms inspected shows that the rejuvenating of the badly "poached" sward entirely by reseeding from the hay fed is not achieved generally, and the deteriorated sward is invaded by weeds, adding to a problem already assuming great proportions for all grassland farmers.

Age of Pastures.

The following data indicate the age of the pastures: Three to seven years, 75; seven to ten years, 21; ten to fifteen years, 52; fifteen to twenty years, 38; over twenty years, 73.

While additional areas are being sown down each year, much of the production of the territory is secured from the older and in some cases surface-sown pastures. This year all but two of the leading championship pastures were over ten years old, and this again emphasizes the fact prominent in the last pasture competition that there is room for improvement in preparation of land and seeding-down as well as in management and utilization.

Time of Sowing.

The time of sowing was given in only 186 cases, and of these 140 were sown in the autumn and forty-six in the spring. The latter were mainly in the southern and central districts, where frosts and cold wet conditions render autumn sowings of rather doubtful value. If farm labour could be suitably provided in these districts a February sowing might be effective under favourable weather conditions, and such sowing is well worth a trial when spring sowings are so apt to be affected by prolific weed-growth.

Quantity of Seed per Acre.

The following quantities of seed per acre were sown in 161 of the fields entered: 30 lb. to 40 lb., 39; 40 lb. to 44 lb., 33; 45 lb. to 49 lb., 47; 50 lb. to 54 lb., 25; 55 lb. to 59 lb., 4; 60 lb. to 65 lb., 13.

In connection with sowing down, one weakness still apparent and not mentioned in the report for last year is clover deficiency. The importance of thorough working to provide a firm and moist seed-bed has already been emphasized, and it is probably the lack of consolidation which results in poor clover strikes. This weakness in the young sward possibly affects the later top-dressing of the pasture, but it is obvious that if the clover can be established in the very young pasture it will be of considerable value not only in the grazing it provides but also in its effect on the grasses in the mixture.

Manure with the Seed.

Of 161 entries, fifty were sown without manure. Details in regard to the balance, numbering 111, are as follows: Superphosphate, 33; superphosphate plus bonedust, 25; superphosphate plus lime, 16; blood and bone, 3; basic slag, 8; superphosphate plus slag, 4; superphosphate plus blood and bone plus potash, 2; proprietary grass manures, 20.

Subsequent Top-dressing.

The following table indicates the fertilizers used in top-dressing during recent years :—

	1935.	1934.	1933.	1932.
Basic slag	27	9	17	30
Superphosphate	45	23	31	36
Lime plus superphosphate	35	22	21	19
Slag plus superphosphate	10	4	3	4
Slag plus potash	1	1	1	..
Superphosphate plus potash	9	8	4	2
Lime plus superphosphate plus potash	23	..	..	..
Phosful	12	..	..	..
Superphosphate plus Phosful	4	..	..	..
Nauru	1	..	..	..
Ammoniated superphosphate	10	2	..	..
Slag plus ammoniated superphosphate	1	..	..	..
Lime plus superphosphate plus blood and bone	2	..	..	..
Superphosphate plus blood and bone plus potash	7	..	..	..
Superphosphate plus slag plus potash	1	..	..	..
Slag plus bonedust plus potash	2	..	..	..
Lime plus potash plus ammoniated superphosphate	1	..	..	..
Proprietary grass-mixtures	53	19	9	6
No manure	8	9	7	..

In considering the above table it must be remembered that in 1935–36 there were 252 entries, compared with 107 last year, 115 in 1933–34, and so on, and consequently in comparing different years proportionate calculations should be made.

The majority of farmers still firmly believe in the outstanding value of basic slag, and in a large number of cases the manures or manurial mixtures above are the result of an endeavour to replace this imported article. This fact is borne out by the orders for basic slag for the current season, when the decreased price, together with the fact that there are more funds available for purchase of manures, has resulted in the importation of approximately 30,000 tons, as compared with roughly one-fifth of that quantity last year. The continued use of basic slag is probably in part due to the clover deficiency previously mentioned, as it is generally admitted that clovers respond most economically to the more slowly acting phosphates. Obviously where grass is dominant in the sward the addition of straight superphosphate rarely affects the balance of the ingredients in the way of stimulating clovers, but usually gives increased bulk. The utilization of this flush of feed has in most cases been incomplete, and has resulted in a prejudice against the more quickly acting phosphate, and has also a tendency to make users return to the slowly available one with whose effects they are familiar. Again, in seeking to replace basic slag, the nearest and most economical substitute would either be a mixture of lime plus superphosphate or else early liming followed by straight superphosphate. While the marked increase in importation of basic slag indicates the farmers' preference, there are a number of very successful farmers who have evolved a mixture suitable for their country, and in each of these superphosphate figures usually with lime and potash. It is also of interest to note the efforts made by fertilizer firms whose mixtures usually contain lime and superphosphate with potash and some nitrogenous fertilizer. Such proprietary

mixtures were applied on fifty-three fields entered, and this is a considerable increase proportionately compared with the figures of last year. Possibly the basic slag now being applied will effect improvement in pasture production, but it has not yet proved itself to be generally more economical or capable of giving greater increases in production on well-managed pastures in good heart than other mixtures of equal cost. One of the outstanding pastures this season is one where no basic slag has been used for some years, and the sward is maintained in good heart by following the practice of rotational grazing and applications twice a year of lime, superphosphate, and 30 per cent. potash.

Many of the entries judged have been top-dressed with shed washings, and this is definitely a payable practice limited only by the contour of the farm. The total cost of the whole outfit, including pump, 200-gallon tank, sledge, and 500-gallon sump, is under £30, while maintenance costs are low. Particularly where the sump can be established to allow gravity feed into the tank, the labour is light and more than repays the outlay and additional work involved. This method of returning valuable ingredients to the pasture is invaluable, and it is encouraging to see the increase in number of plants now operating with excellent results.

Quantity of Artificial Fertilizer used.

The quantity of fertilizer applied was—

—	1935.	1934.	1933.	1932.
2 cwt. per acre	6	4	3	3
3 cwt. per acre	195	76	82	84
4 cwt. per acre	27	12	13	17
5 cwt. per acre	13	6	2	3
Over 5 cwt. per acre	11	..	..	..

The proportion of those applying 3 cwt. per acre has increased slightly since last year, but the greatest improvement is in the number top-dressing at the heavier rates, and this usually involves two applications, one in the summer and the other in the early spring. It is not sufficient to apply 3 cwt. per acre of fertilizer and then expect all weeds to disappear and good grasses and clovers to take their place. Many areas top-dressed give doubtful returns for the money spent, and, particularly at this time when production-per-acre is all important, a close study of the sward before deciding on the top-dressing programme is a matter of necessity. This season has been a good one for surface-sowing of seed, and the results already noted indicate that this method of rejuvenating the deteriorated sward is sound practice and gives a pasture which will give payable returns from top-dressing since the newly established good constituents give highly nutritious feed, and the whole field so treated need not be shut up for very long.

Types of Harrows.

Harrowing of pastures generally is a highly controversial matter, not so much as to whether it should be done or not, but more particularly in regard to the type of implement to be employed.

More than half of the makes used are of the lighter types which spread droppings and remove roughage, but adherents of the "drastic" practice are firmly convinced that the results they obtain definitely are payable. It will be conceded generally that where undesirable plants such as blackberry, gorse, and possibly also pennyroyal, are to be eradicated the heavier types of harrows are to be preferred to the lighter makes. Where a sod-bound turf occurs, and this in the territory under review usually is encountered only where paspalum is dominant, the heavier harrow should be employed; but general pasture experience has not yet shown the value of root-pruning and soil-aeration. Where weed-growth is so prolific as in North Taranaki the tendency is for the spaces left after drastic harrowing to be rapidly occupied by weeds and weed grasses. Consequently it seems that this severe harrowing should be followed by surface-sowing, and this harrowing, which is really a form of pasture cultivation, will probably become standard practice for rejuvenating deteriorated pastures where root crops are not grown or where the area in sown grasses does not allow the shutting-up of the particular field for a long period.

The following table shows the number of strokes of harrows given to the various entries: 1 stroke, 79; 2 strokes, 91; 3 strokes, 19; 4 strokes, 19; 5 strokes, 8; 6 strokes, 11; 7 strokes, 1; no harrowing, 34.

Carrying-capacity.

The carrying-capacity (expressed in acres required for one cow) of the entries in the dairy class, grouped according to size of farm, were: Up to 50 acres, 1·79; 51 to 75 acres, 1·95; 76 to 100 acres, 2·00; 101 to 150 acres, 2·14; over 151 acres, 2·28.

The champion pasture for the season was the No. 1 entry in the dairy class of Mr. J. N. Blyde, Lepperton, which was awarded 182½ points, the field being 3½ acres in area and over twenty years old. This paddock has shown steady improvement as indicated by the fact that in competitions it has been ninth, sixth, fourth, and second, and this year secured highest honours in the North Taranaki Championship. Areas on this farm were top-dressed twice a year as follows: 1932—2½ cwt. superphosphate in spring, plus 3 cwt. Calciphos in winter; 1933—2½ cwt. superphosphate plus 1½ cwt. 30-per-cent. potash in spring, plus 5 cwt. lime, 2½ cwt. superphosphate, and 2 cwt. 30-per-cent. potash in winter; 1934—2 cwt. superphosphate and 1¼ cwt. 30-per-cent. potash in spring, and 4 cwt. lime, 2½ cwt. superphosphate, and 1½ cwt. 30-per-cent. potash in winter; 1935—2½ cwt. superphosphate and 1¼ cwt. 30-per-cent. potash in spring, with 4 cwt. lime, 2½ cwt. superphosphate, and 1¼ cwt. 30-per-cent. potash in winter. The sward is dominant rye-grass, white clover, timothy, and cocksfoot, and is very even throughout, while it was harrowed twice during the season, received four applications of shed washings, and was topped once between spring and autumn judgings. The standard of pasture and pasture-management on this farm is shown in the fact that a return of 340 lb. butterfat per acre for the season is anticipated.

Mr. R. Cassie, Okato, secured second place with a 5-acre field three years old, sown in the spring with 40 lb. of seed per acre, 3 cwt. per acre superphosphate and bonedust being applied at sowing. This entry was in very good heart, and was awarded 182 points in the open championship in the dairy class. In 1934 it was top-dressed with 2 cwt.

per acre of Phosful, and last year received 2 cwt. Phosful in the autumn followed by 2 cwt. ammoniated superphosphate in the spring. The sward was remarkably even and well balanced, being dominantly rye-grass, cocksfoot, and white clover, with very little weeds present.

Mr. W. F. Goodin, Okato, was third with a field of 17 acres, twelve years old, sown in the autumn with 60 lb. seed per acre, while in 1933 it was top-dressed with basic slag, in 1934 with guano, and last season again with slag, all at 3 cwt. per acre. It was harrowed four times during the year with chain and tines and was very even throughout.

In the open-grazing class for mixed stock first place was secured by K. W. Jackson, Ngaere, with a six-year-old field of 4 acres sown in the autumn with 45 lb. seed per acre. The area is well sheltered and is dominantly rye-grass, cocksfoot, and white clover, giving a dense sward largely grazed by pigs. It was top-dressed in 1933 with African phosphate 3½ cwt. per acre, in 1934 with lime 7 cwt. plus superphosphate 4 cwt. per acre, and last year with 3½ cwt. per acre of proprietary mixture. The field was harrowed twice with a tripod, and was remarkably free from weeds, indicating the value of mixed grazing in this connection.

Messrs. J. Cloke, Lepperton, and W. J. Bridgeman, Okato, tied for second place in this class, each receiving 180½ points.

The Lepperton entry was eighteen years old and 5 acres in area, being grazed with dairy cows and sheep. In 1933 it was top-dressed with basic slag, 4 cwt. per acre, in 1934 with blood and bone, 4 cwt., and last year with lime, superphosphate, and potash, 4 cwt. per acre, while it was drastically harrowed three times during the season.

The entry at Okato was thirteen years old and 4½ acres in area, sown in the autumn with 48 lb. seed per acre, 3 cwt. bonedust, superphosphate, and lime being applied at sowing. In 1933 it was top-dressed with 3 cwt. ammoniated superphosphate in the spring, followed by 3 cwt. superphosphate in the autumn, in 1934 with 3 cwt. lime, superphosphate, and bonedust, and last year with 3 cwt. lime and superphosphate. It is grazed by pigs and sheep and was harrowed once with the tripod.

In the improvement class the winner was Mr. B. J. Fabish, of Inglewood, whose entry showed considerable thickening-up of the sward and introduction of better pasture constituents.

Mr. B. Dixon, Tarurutangi, was second, and in this case greater consolidation and spreading of droppings after stock concentration was one of the main reasons for improvement. Stimulation of rye-grass was the outstanding feature of the pasture, together with a general thickening-up of the whole sward.

Mr. L. F. Bishop, Tarurutangi, secured third place with an entry which has shown steady improvement during the last few years, and owes its position to-day to a considerable increase in the proportion of good grasses and also to improved bottom growth generally.

NORTH ISLAND LAMBING ESTIMATE.

From information supplied by Inspectors of Stock in the various districts, the average lambing for the current season in the North Island is estimated at 90·5 per cent., compared with 83·68 per cent. in 1935. With 10,300,826 breeding-ewes in the North Island, as shown in the 1936 sheep returns, the number of lambs this season is estimated at 9,322,476. South Island and Dominion returns will be given in next month's issue of the *Journal*.

WHEAT VARIETIES, HARVEST OF 1936.

THE figures appearing in the following table were compiled from monthly returns furnished by proprietors of threshing-machines up to 26th September, 1936. The area accounted for in this manner was 217,904 acres, out of a total area of 248,639 acres of wheat threshed, according to the annual collection of agricultural and pastoral statistics carried out by the police on behalf of the Census and Statistics Office.

Variety of Wheat threshed.	Area threshed.	Total Yield.	Average Yield per Acre.	Percentage of Total Area.	Percentage of Total Yield.
Tuscan—	Acres.	Bushels.	Bushels.		
Solid-straw Tuscan ..	150,980	5,768,816	38·21	69·29	68·67
Dreadnought ..	6,692	283,488	42·36	3·07	3·37
"Cross 7"	1,368	61,744	45·13	0·63	0·73
Montana King ..	905	33,595	37·12	0·42	0·40
Hollow-straw Tuscan ..	594	23,722	39·94	0·27	0·28
Solid-straw Velvet ..	590	26,199	44·41	0·27	0·31
Sensation	326	13,095	40·17	0·15	0·16
Red Marvel	110	2,247	20·43	0·05	0·03
Victor	98	4,609	47·03	0·04	0·05
Bencubbin	97	2,633	27·14	0·04	0·03
Other Tuscan varieties	173	7,141	41·28	0·08	0·09
Totals	161,933	6,227,289	38·46	74·31	74·12
Hunters—					
Hunters	33,478	1,413,510	42·22	15·36	16·83
Major	1,317	34,363	26·09	0·61	0·41
Federation	933	31,735	34·01	0·43	0·38
Yeoman	155	5,161	33·30	0·07	0·06
Totals	35,883	1,484,769	41·38	16·47	17·68
Pearl—					
Jumbuck	14,676	500,901	34·13	6·74	5·96
Pearl and Velvet ..	2,293	80,387	35·06	1·05	0·96
Garnet	749	21,045	28·10	0·34	0·25
Marquis	2,370	86,805	36·63	1·09	1·03
Totals	20,088	689,138	34·31	9·22	8·20
Totals, all varieties	217,904	8,401,196	38·55	100·00	100·00

Due to differences in soil types, localities, times of sowing, and climatic conditions, all of which influence the choice of wheat varieties sown, the yield-per-acre statistics cannot be regarded as the sole criterion of the relative fruitfulness or desirability of the individual types. Again, other factors—*e.g.*, quality of wheat, resistance to wind, adaptability to humid conditions, &c.—have to be taken into account.

—*Monthly Abstract of Statistics.*

CHECKING QUALITY OF FERTILIZERS.

THE Department of Agriculture is desirous of the assistance of farmers in checking the quality of fertilizers on the market, and farmers are urged to send forward samples for analysis. No fee is charged for this work, and in the event of any deficiency being found an official sample of the fertilizer will be taken from the vendor's store by an Inspector under the Fertilizers Act. This will enable the Department to decide whether legal proceedings should be taken if discrepancies occur.

In connection with samples of this nature, a portion of the fertilizer should be taken from each of a number of bags, and the portions thoroughly mixed together. Finally, an amount weighing about 1 lb. to 2 lb. may be put into a clean, dry tin or jar, and forwarded with the invoice certificate (or a copy of it) addressed to the Inspector of Fertilizers, Department of Agriculture, Private Bag, Wellington, C. 1. It is important that the invoice certificate should accompany any sample sent, or, if no certificate has been supplied, the name and address of the vendor and the brand of fertilizer should be given.

SEASONAL NOTES.

THE FARM.

Sowing of Arable Crops.

Of the crops customarily sown at this season, the swede is an important crop which temporarily at least has gone out of favour to some extent in certain districts, partly because of the serious ravages of insect pests. In this connection it is to be noted that the prospects of controlling the ravages of the white butterfly, which attracted so much attention, now seem good. Over wide areas good results are obtained consistently from season to season by sowing swedes in December at a date which enables the seedlings to escape the main flight of the beetles of the grass-grub. The brown beetle (the adult stage of the grass-grub) is responsible for much, if not all, of the insect activities attributed to the "turnip-fly," and so, unless guarded against, is a serious obstacle to successful growing of swedes and soft turnips. The beetle eats only those portions of plants which are above ground, and hence the effect is greatest on plants which are in the seedling-leaf stage, for, in the case of such plants, both leaves and stalk may be removed and the plants thereby destroyed; the removal of an equal amount of more advanced plants may be followed by a setback, but also by eventual recovery. Normally the beetle either destroys a crop wholly or destroys patches of it completely, leaving other patches relatively unharmed, so that it does not suffice to employ heavier amounts of seed. The main damage is likely to take place between the first week in November and the first week in December, but it varies to some extent from year to year, and probably also from district to district. Successful results may be expected from sowing swedes at the rate of 10 oz. to 14 oz. an acre through every second coulter of an ordinary grain-drill, but sowing the same quantity of seed through every coulter has also given good results, and, especially in the South Island, sowing on ridges 26 in. apart at the rate of 12 oz. to 16 oz. of seed an acre, followed by intertillage, is widely practised, and consistently gives heavy yields. A fine firm seed-bed favours a good "strike" of swedes. A practice which continues popular in districts of good rainfall is the application of 2 cwt. to 3 cwt. an acre of manure of which phosphate is the dominant constituent, while in districts of relatively low rainfall 1 cwt. to 1½ cwt. an acre of such manure is favoured. When the seed is mixed with manure for sowing, injury to the seeds through bringing them in contact even for a short time with soluble manures, such as superphosphate, sulphate of ammonia, and potash salts, should be avoided. The injury caused by superphosphate can be eliminated by mixing the superphosphate with an equal weight of ground limestone (carbonate) about a week before sowing. The mixture usually sets hard, and so should not be bagged until it has been made two or three days, when it may be pulverized easily in the heap. Farmers' field competitions indicate that in northern districts Superlative Grandmaster and Majestic, and in Southland Elephant and Masterpiece, are widely used. This choice of varieties by farmers is in general agreement with the results of work relative to varieties carried out by the Department.

It should be kept in mind that seed of soft turnips and rape are subject to injury similar to that caused to swede-seed by soluble manures. Turnips commonly are sown in 7 in. drills at the rate of 12 oz. to 14 oz. of seed an acre, in 14 in. drills at the rate of 8 oz. to 14 oz., and in 26 in. drills with subsequent thinning at the rate of 8 oz. to 14 oz. an acre. Rape commonly is sown at the rate of 2 lb. to 3 lb. an acre. As a rule both of these crops

respond profitably to a dressing of artificial fertilizer in which superphosphate is the dominant constituent. The amount of fertilizer that should be used varies with the actual fertility of the soil and the rainfall during the growing-season of the crop; seldom should it be less than 1 cwt. an acre, and on somewhat poor soils in districts of good rainfall a considerably heavier dressing may prove profitable.

One of the matters which militate against the more extensive use of cruciferous crops except chou moellier—*e.g.*, swedes, turnips, and rape—has been club-root. Field investigation shows that the damage by club-root is intensified by the use of superphosphate, whereas it is lessened by the use of lime and of basic slag. Hence, superphosphate alone should not be used with these crops when an attack of club-root is considered possible. The danger of club-root may also be countered to some extent at least by the use of resistant varieties, such as Wilhelmsberger swede.

Maize and millet to provide green feed usually may be sown successfully in December. Almost always these crops give a profitable result from an application of 1 cwt. to 2 cwt. an acre of superphosphate, and unless the soil is highly fertile it generally is profitable to supplement the phosphatic material with nitrogenous fertilizer, such as blood and bone and sulphate of ammonia. Good results have followed the sowing of maize broadcast at the rate of 75 lb. to 100 lb. an acre and covering the seed by a shallow ploughing, while disking has been employed satisfactorily as an alternative to such ploughing. Early Butler, Ninety-day, and Yellow Horsetooth are favoured varieties. A sowing of 15 lb. to 20 lb. an acre of millet is standard practice, and, although considerably heavier sowings are sometimes recommended, definite evidence in support of them on seed-beds which have been satisfactorily prepared seems not to be available, or at least has not been noted.

Generally, the best results are obtained by sowing lucerne in the latter part of November or in December. A fine, firm seed-bed is essential for best results in establishment, and rapid vigorous establishment contributes greatly to subsequent good results. It is good practice to sow through every coulter of the grain-drill from 12 lb. to 18 lb. an acre of seed; a greater quantity of seed is advisable when the seed-bed has been prepared somewhat poorly. Broadcasting and covering of the seed by light harrowing is an alternative practice, usually not quite as satisfactory as drilling. Generally lime may be applied with profit before the final cultivation preceding seed-sowing. Many of the past complete or partial failures with lucerne are now known to have been due to the absence from the soil of particular organisms with which lucerne collaborates in an important manner essential to its thrifty development. There is no way which could be used by farmers of discovering, before growing the crop, whether the soil is inhabited by sufficient numbers of these organisms. Hence although the organism is present in some soils in ample supply for full success with lucerne, yet the safest course is to supply the organisms artificially. This is termed inoculation, and the supplies of the necessary organism, which are called cultures, are obtainable from the Department of Agriculture at a cost of approximately 1s. for the treatment of the seed for an acre. Suitable treatment of the seed with cultures may be nullified subsequently by bringing the seed into contact with soluble fertilizers, such as superphosphate, sulphate of ammonia, nitrate of soda, kainit, and other potash salts. When it is desired to sow seed and fertilizer together this may be done safely by using an insoluble manure, such as basic slag, or by sowing the seed with superphosphate and carbonate of lime mixed in equal proportions for about a week before bringing the seed in contact with the mixture. Much information about the establishment and general management of lucerne is given in Bulletin No. 155, which is obtainable free of cost from any office of the Department of Agriculture.

Chou moellier for winter use may be sown towards the end of November or in early December. Chou moellier at times is of special value because of its marked resistance to club-root. It is of good feeding-value; it calls for relatively little labour both during its growth and in feeding it to stock; under reasonably good conditions it consistently gives crops of quite satisfactory yield. It is preferred instead of swedes where the winter-feeding conditions are expected to be so wet that undue wastage of the swedes would occur through the trampling of the roots into the mud, but good crops of chou moellier are not obtained on soils which are water-logged during the growing-period.

Intertillage and Thinning.

Often in December intertillage and thinning of crops sown in October and November should be carried out. Usually the thinning may be carried out more easily as the result of prior hoeing along the rows. Thinning is most valuable if done as soon as the seedlings are large enough to be handled without undue difficulty. Weeding carried out at the same time as such early thinning results in the destruction of weed seedlings at a very vulnerable stage. In thinning mangels the soil should be drawn away from the plants rather than hoed up to them. The value of the cultivation which produces a good seed-bed seems to be well known, although the knowledge is not always applied, but the value of cultivation after the sowing of the seed seems not to be so generally recognized. This type of cultivation is of special current importance first of all because of its great value in the control of weeds, and apart altogether from this is the fact that a growing crop in badly cultivated ground does not obtain the full benefit from money spent on good seeds and the liberal use of suitable fertilizers. Hence intertillage of growing crops sown in rows wide enough apart to allow of it is as a rule highly desirable even though weeds are not prominent. This is especially so in the drier districts. In brief, inadequate cultivation is one of the commonest and greatest causes of unnecessarily and unprofitably low crop-yields.

Utilization of Surplus Growth of Pastures.

At this season a task of major importance lies in using to the best advantage the surplus growth of pastures. Three facts govern the position: if the surplus growth is not properly managed there is great danger of a serious decline in the quality of the whole feed-supply available from pastures; the amounts of hay and silage usually made from surplus growth of pastures are less than could be fed, with economic results, to the stock being carried; and yet, as a rule, only portion of the surplus feed available is converted into hay or silage. At times this position may be justified by the circumstances, but frequently it cannot be justified, especially on dairy-farms, but often also on sheep-farms.

The Quality of Hay.

Much of the hay saved is of decidedly poor quality; this is not always the fault of those carrying out the haymaking. Indeed, often it is the result of climatic conditions over which they have no control—a fact which points to the desirability of increased ensilage, especially in dairying districts in which the summer weather often is uncertain. Two matters which greatly influence the quality of hay are the time of cutting and the amount of rain which falls on the mown material.

The right time to cut is when the majority of the plants in the herbage have just passed the bloom stage—*i.e.*, when they have just scattered their pollen. If the crop is cut later the hay will be undesirably woody and stemmy, relatively indigestible and unpalatable, and of such poorer nutritive value than if cut at the bloom stage that any increase in the weight of the crop, which is not always to be noted, is more than counterbalanced by the falling-off in feeding-value. On the other hand, if the crop is cut earlier

the yield is less, and, moreover, the leaves are so tender and succulent that they are difficult to dry and are apt to be broken off in the haymaking. During broken or bad weather, if ensilage is impracticable, it is better, however, to allow the crop to stand than to cut it and incur the great loss that may be caused by weathering.

It is highly advisable to cut no more hay then can be handled conveniently by the equipment and staff available should rain be expected. Rain falling on cut herbage washes away large amounts of the soluble constituents, and dampness may lead to fermentation, which brings about a further loss of nutritive matter. Sometimes as much as one-third of the weight of the crop is lost in this manner, and this loss represents more than one-third of the feeding-value of the crop, for the loss is confined almost wholly to the most digestible and most valuable part of the crop. If adverse weather occurs immediately after mowing, the cut material should not be handled until fine weather seems to have returned: handling of mown material increases the readiness with which nutriment is washed out by rain. The farmer should use implements which cause the minimum damage to the crop, and in this respect it is to be noted that though the tedder is more effective in its drying action it is more damaging than the swath-turner, and is very prone to break off brittle leaves, especially those of clovers.

If the crop is light and the weather favourable practically no "making" is necessary, but generally efficient haymaking is not such a simple practice. It is questionable whether in the principal haymaking districts a heavy crop of hay can be saved in good condition without cocking, and it certainly may be said that cocking should be more widely practised. Cocking is the ideal method of obtaining hay of the best possible quality when the weather is somewhat adverse. Cocking is of great value in the saving of lucerne and of clover hay of good quality. The leaves of clover and lucerne, which are much superior in nutritive value to the stalks, readily dry and shrivel as the result of being left in the swath during bright, sunny weather, and when the hay is raked they crumble and are lost. Cocks, unless well made, are likely to be harmful rather than useful. A well-made cock is well hearted and raked and capable of shedding much rain, whereas a poorly-made cock is merely a heap which readily becomes sodden when subjected to rain. If bad weather is expected, cocking should be hastened, for the amount of washing-out of nutritive matter by rain is much greater when the herbage is in the swath.

The best time to mow lucerne cannot be determined always by the flowering development. Safer guidance is provided in the development of basal shoots; when fresh shoots at the bases or crowns of the plants are about 1 in. long the lucerne should be mown.

Means to Improvement in Ensilage.

In many instances ensilage is wasteful because it leads to avoidable loss in nutritive value. The common faults in practice that lead to such loss may be indicated briefly as—

(1) Too late cutting of the crop, which results in unduly stemmy silage, with which are associated all the undesirable features of over-mature pasture-growth. Silage is as a rule somewhat inferior in feeding-value to the green material from which it is made, hence if one starts with stemmy material of low digestibility, low content of mineral matter, and poor balance of nutritive constituents, the resultant silage is of similar nutritive character. Further, late cutting gives less likelihood of a heavy leafy aftermath, which often is of great value during late summer, when leafy feed is likely to be in inadequate supply.

(2) Insufficient consolidation of the green material in pits and trenches: This results in avoidable wastage due to decay at the sides. In practice, the green material is almost never over-consolidated. The more stemmy the material the greater the need for thorough consolidation of the green material.

(3) Excessive temperatures, which are indicated by the production of dark-brown or almost black silage instead of greenish to light-brown silage. The latter, when made from the same sort of green material, possesses greater feeding-value unless a substantial amount of nutriment has been lost by the escape of liquid from the silage; the amount of liquid that escapes from silage largely governs the loss of nutriment, and depends chiefly upon the amount of water in the green material. Hence loss in this respect is greatest from luscious material or from material harvested in wet weather. High temperatures affect adversely the feeding-value of silage, because they are associated with a greater loss by combustion than takes place at lower temperatures and a falling-off in the digestibility of the remaining material.

(4) Insufficient or delayed covering of the stored silage with material of enough weight to eliminate avoidable surface wastage by excluding the air as far as possible. The earth or other covering material should be placed on the silage practically as soon as the carting in is finished. Special care is needed to have the sides sufficiently compressed by bringing the weighting material right out to the edge of stacks.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Cultivation.

THE maintenance of a good tilth by frequent cultivation should on no account be neglected. Good cultivation not only maintains soil aeration, but helps to retain moisture and generally provides conditions suitable for maximum crops and tree-growth. When each implement used for cultivation is finished with for the season, it should be placed in a dry shed in readiness for use when again required. The plough or any implements with a bright surface should be thoroughly greased so as to prevent rusting during the period they are not in use. This precaution incidentally saves considerable time and annoyance when such implements are again brought into use. An easy way to minimize rusting is to rub waste engine-oil over such surfaces as mould-board, &c.

Fireblight.

As the blossoming is practically over, the period for a general infection has now passed. However, the danger of local infection will be present if sucking and chewing insects are not controlled. Fireblight is much more virulent on quince and pear than on apple trees. Branch canker on the latter is not usual, infection being confined more to the blossoms and laterals. On pear-trees, however, the organism spreads very rapidly to the larger limbs, and when this occurs there is little or no hope of saving the tree. Therefore, it is recommended that such infected trees be taken out by the roots and destroyed by fire at the earliest possible moment.

Control of Pests and Diseases.

Spraying operations recommended in these notes for September and October last should be continued for the control of pear-scab, black-spot, powdery mildew, codling moth, leaf-roller caterpillar, red mite, &c., on pome-fruit trees, and for the control of brown-rot, aphis, leaf-rust, shot-hole fungus, &c., on stone-fruit trees. Apples and pears should be sprayed with lime-sulphur (polysulphide content 15 per cent. 1–180) for the control of black-spot and powdery mildew (this is also beneficial in controlling red mite) plus arsenate of lead (powder) 1½ lb. to 100 gallons for control of codling moth. On the more tender varieties of apples, such as Cox's

Orange and Sturmer, and weakly trees, it is recommended when combining arsenate of lead and lime-sulphur mixture to add 3 lb. hydrated lime to every 1½ lb. arsenate of lead used to prevent scorching of foliage and russeting of the fruit. From the time these notes are published, applications should be made at intervals of fourteen to twenty-one days, providing the weather conditions continue to remain dry. In those localities, however, subject to fogs, heavy dews, or misty rain, the period between the spray applications should be reduced accordingly. If a high pressure is maintained a good coverage of all tree-parts is more readily obtained. Varieties of apple-trees that are subject to attack by powdery mildew should be examined at least twice during the growing-period, and, as far as practicable, infected shoots cut out and destroyed by burning. This practice is essential in certain localities for the satisfactory control of the disease.

Grafts.

All trees that have been grafted during the present season should be examined frequently. Where good growth has been made (and the scions not fastened in by tingles) the binding can now be cut. This is best done by drawing a sharp knife from top to bottom of the binding and as far distant from the scion as possible. It is not necessary, or even advisable, to further remove the binding, which is still affording the union a certain amount of protection. Shoot-growth from the stock should not be allowed to overcrowd the scion, and should be checked periodically by pinching back.

—B. G. Goodwin, Orchard Instructor, Christchurch.

Citrus Culture.

The October notes dealt with some of the principal diseases which are active in the spring. According to district and climatic conditions the time of the initial development of these diseases varies considerably, and it is unlikely that all matters requiring attention can be dealt with exactly to schedule, so that what was written for October applies generally for November.

Bark blotch, for instance, is a disease which requires attention over several months of the growing-season. In a grove where it is prevalent more than one inspection will be necessary, as new outbreaks are likely to occur from time to time. Diseased tissues should not be scattered about, but gathered up and destroyed. Infected chips of wood are a source of contamination, and if left about they may be the cause of additional outbreaks of the disease.

Black scale (Saissetia oleae): There appears to be considerable misunderstanding among citrus growers as to the correct naming of this pest, which is very frequently referred to as the "brown" scale. Another scale (*Chrysomphalus rossi*), which is quite large and very flat, appears on oranges and elæagnus and is often referred to as the "black scale"; it is also known as the "native" scale. It is important that scales should be given their correct names, otherwise confusion may occur when control measures are being discussed. No doubt the reason why the black scale is so often referred to as brown is because only at a very late stage in its life cycle can it be said to be black in colour, and until that stage is reached it is certainly brown.

There is also to be found on lemons a brown scale (*Saissetia hemispherica*) about the same size as the black, and a large brown one (*Lecanium*).

The black scale can be recognized quite easily owing to the fact that the markings on its back form a distinct letter "H," while the brown scale is quite smooth and does not show the raised markings. The honey-dew exuded by *Saissetia oleae* is the principal cause of the appearance of the black, sooty mould often seen on citrus fruit and foliage. The mould itself (*Capnodium citricolum*) is a saprophyte—that is, it lives on dead matter,

and also the honey-dew exuded by the scale. Although it is present in many groves, the black scale does not appear to affect to any great extent the vitality of the trees which it attacks. The steel-blue ladybird (*Orchus chalybus*), wherever present, maintains reasonable control over this pest, which does not affect the fruit, but confines its activities to foliage and wood. In cases where the scale is not being satisfactorily parasitized, a summer-oil application at 1–100, applied while the young scales are emerging freely, should be effective. The black scale generally passes the winter in the egg-stage, the large adult scales being full of minute white eggs, which hatch in late spring or early summer.

Verrucosis: In some localities the trees may now be just reaching the "fruit-set" stage, so that the application of Bordeaux 3–4–50, plus summer oil 1–100, should be made forthwith. The oil, besides acting as a spreader, is useful where young black scales have hatched. While one Bordeaux spray correctly timed is generally sufficient for the clean orchard, it is unlikely to be adequate for groves which have had a bad infection of the disease. The owner of such trees must realize that, for the first season at least, considerable extra effort will have to be expended. Verrucosis infection takes place when the fruit is very small, so that the protective covering of Bordeaux must go on as soon as possible after fruit-formation—that is, at blossom fall. Where the blossoming extends—as it often does—over a long period, or where it is irregular in the orchard, it would be advisable, in the cases mentioned, to apply an additional Bordeaux so that late-formed fruit may also be protected.

Frequently at this time of the year dead laterals showing white woolly-like fructifications are to be found on citrus trees. This condition is due to the fungus *Sclerotinia sclerotiorum*, an organism which not infrequently attacks laterals injured by frost.

Cultivation: During the month cultivation should be continued. In the case of heavy clay land it may still be necessary to do a certain amount of clod-crushing and working the soil to a fine tilth, while in light sandy soils all that will be necessary will be a light harrowing. On this latter class of land there has been, perhaps, a tendency for some growers to overdo cultivation, particularly where it has been the practice to work deeply. It should be remembered that the sandy soil is generally deficient in humus, and that by constantly turning it over and bringing fresh soil up to the sun the humus is likely to be burned or dried out. It is desirable that it should remain in a moist condition to ensure maximum bacterial activity. During the next three months, provided normal weather conditions prevail, the points to be kept in mind in connection with cultivation are the prevention of weed-growth, the conservation of moisture, and the maintenance of a condition of the soil suitable for the activity of the beneficial bacteria.

Young Trees: These should receive attention regularly. Cultivation should be done carefully. If couch or deep-rooted weeds appear, these should be removed gently, as often they are entwined with the roots of the tree, and if pulled up roughly the young tree suffers damage. Growth, particularly on oranges, is slow to develop, and for the first year it should be the aim to retain as much as possible, provided that it is suitably placed. Shoots which come from below the bud union or on the trunk below the head of the tree should be removed. A close watch must be kept for the appearance of insect pests. Attacks of black aphis, leaf-roller caterpillar, or leaf-eating weevils should be dealt with on the young trees to prevent the development of the tree being retarded through this cause.

Pruning: If not already done, the work of cutting out wood which has been killed by frost, borer, &c., should not be postponed, as there are quite a number of diseases which gain an entrance to the tissues through dead or weak wood.

Picking: During the past few months some growers have refrained from picking in order to fulfil contracts for the supply of large-sized lemons

for the manufacture of peel. With the setting of the new crop, however, an effort should be made to relieve the trees of the over-size fruit so that the normal development of the young crop may not be retarded.

Budding: The present month is one of the most suitable in which to do this work, as the sap should now be moving freely—an essential condition for success.

—*A. R. Grainger, Orchard Instructor, Tauranga.*

POULTRY-KEEPING.

ONE of the difficult problems facing many poultry-keepers during the next few months is to find adequate accommodation for all their birds. Artificial incubation and brooding methods have been so much improved of recent years, and are so much better understood by many, that one has heard it said that young stock are almost too easily obtained. The great danger of modern massed production is the tendency to over-stock. Though poultry is one of the most healthy of live-stock when bred and reared under suitable conditions, there are unfortunately reports to hand from overseas and sufficient evidence in this country to indicate that poultry-keepers must ever be on the watch and guard against disease threatening their industry.

Some years ago when a greater proportion of chickens were reared in the natural way with hens, and when those who reared artificially never thought of placing more than fifty chickens in a brooder, less was heard of disease and mortality amongst poultry flocks.

Environment.

Just how a flock of pullets turn out during their adult stage is as much a result of the opportunities given to them to develop properly during their growing-period as to their pedigree; in other words, environment plays a very important part regarding the stamina and vitality they may possess for their adult function.

While it is fully realized that environment cannot make up for a lack of judgment in the selecting of breeding-stock, at the same time young stock from the very best of parents cannot be expected to stand up to a long laying-season and prove good breeders if conditions during their early life are such that their vitality is lowered or their development checked at any one period.

Culling of Young Stock.

To be profitable, birds must have a good constitution, vitality, and a great power of endurance. However, no matter how well-bred and carefully handled a flock of pullets has been, there is usually a proportion that do not do as well as the majority, and some that will never turn out profit-makers. To a large extent success in poultry-keeping depends upon the ability and courage of the poultry-keeper to be able to pick out and get rid of such birds before they have cost him too much. Quite a few of the less experienced poultry-keepers and many beginners seem to fail to realize the great importance of culling young stock, with the result that many late, weedy pullets that will never be profitable and are only a source of danger on a plant are kept simply because they are pullets.

Slow growth and poor feathering are indications of weakness, and such birds, together with all weakly and deformed stock, should be culled, for it is a waste of time and money to try to rear birds of poor constitution. As previously mentioned, such birds are a source of danger on any plant, as they often start an outbreak of colds and roup, which are easily contracted owing to their poor constitution and lowered vitality and their susceptibility to such troubles.

The Surplus Cockerels.

By getting rid of all surplus cockerels as soon as they are large enough, more room will be available for the developing pullets. If a certain number of cockerels is to be kept for breeding purposes, it is advisable to mark those that grow well into plump, full-chested, weighty birds, possessing masculine characteristics. While the good breeding cockerel should have a strong masculine head, indicating vigour and constitution, it should also possess that body-weight required for the breed it represents.

The novice is often inclined to select as future breeders those Leghorn cockerels which crow first, have the largest combs, and are the most precocious. However, this class of cockerel may be likened to the pullet that matures and starts to lay at four months and a half old. They seldom make good breeders, as they come to maturity before their frames have had time to develop, and although they show up early and appear to grow more quickly up to a certain period than the rest of the brood, it will be noticed a little later that those birds that develop a little more slowly, with a well-proportioned body and no excessive development of the comb, generally turn out the best. Therefore when selecting early cockerels it is advisable to select those with good, well-proportioned bodies, that show character, will not be harassed by the rest, show vigour and constitution, but seem to develop their frames first and the reproductive organs after.

Culling of Hens.

Opportunity should be taken at the present time to go carefully through the flock and cull out any hens showing lack of vitality and constitution. Hens which are overfat, thick of abdomen, dried up in comb, or coarse in pelvic bones, Leghorn hens with yellow legs and beaks, at this time of the year may safely be put out. By handling a few birds regularly the novice soon gets into the way of picking the laying-hens from the non-producers.

A good layer's abdomen is soft, thin, and flexible like the udder of a good milking-cow, the pelvic bones are thin and pliable, while the poor layer's or non-producer's abdomen usually is thick and coarse in comparison, and at times rather hard, while the pelvic bones usually are thick and stiff.

Where a large number of birds is kept and culls are being marketed regularly it is a good plan to have a few fattening-coops or a small yard where stock can be primed for a couple of weeks before being sent to market, and when birds are sold alive in the market, if they are carefully graded into even sizes, they sell better and realize higher prices than when sold ungraded.

The Young Growing Stock.

Now that the weather is becoming warmer and the young stock are growing, they need more room in their sleeping-quarters. Never let growing birds crowd even for one night, as a few hours of crowding may cause colds to break out. Many outbreaks of cold and roup have been traced to the overcrowding of colony houses and young-stock pens. A visit to these quarters after the birds have gone to roost is time well spent, for though there may be plenty of perching-accommodation young birds are often inclined to crowd together. If this is noticed to be the case, and the birds are gently spread out for a night or two, the habit is broken and much trouble may be avoided. In fact it is advisable if at all possible to place in the colony houses or young-stock sheds only that number of birds that the house suitably accommodates when the birds are grown. By so doing a better class of bird is raised, and there is not the danger of outbreaks of colds or roup.

Care of Incubators.

Now that the hatching-season is over all incubators should be thoroughly washed out with hot water, soap, and disinfectant, and then

left open for a few days so that they may dry out. The lamp and burners should be washed in boiling water, and when dry placed inside the incubator. It is also advisable to unscrew the regulating parts, and place them inside the machine, so as to prevent their being bent or knocked about. The incubator itself should be covered over with a cloth, as by doing this the life of the machine will be lengthened and the value maintained.

Nesting Material.

Various kinds of nesting materials are used by different poultry-keepers. In order to ascertain if birds showed any preference for any particular nesting material a test was carried out at this Department's Wallaceville Poultry Station during the month of July. In each of three houses which housed a total of 140 White Leghorn hens, fourteen nests of a similar make were placed. Two nests in each house contained straw as a nesting material, two pine needles, two straw chaff, two lucerne chaff, two sand, two sawdust, and two oyster-shell grit. The result of the test was that 1,629 eggs were laid during the month: 600 of these were laid in the nests containing straw as a nesting material, 345 in pine needles, 312 in straw chaff, 230 in lucerne chaff, 79 in sand, 44 in sawdust, and 19 in the oyster-shell grit.

While straw proved the most popular with the hens, it did not prove the best nesting material, as, owing to the size of the nest-boxes, the straw nests had a tendency to become too saucer-shaped or deep, with the result that the eggs rolled too much together and more were cracked or broken in these nests than in any of the others. The nest-boxes at Wallaceville are 14 in. deep, 12 in. high, and 12 in. wide.

Straw chaff proved a popular and satisfactory nesting material, but if that material is used care should be taken to see that at least 2 in. deep is used in each nest.

It may be mentioned that previous to this test only fine sand was used in all nests. Straw is more suitable for use in larger nests, and when it is used it is advisable to see that straw is first rubbed between the hands in order to break it up, and too much should not be used in each nest.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Artificial Increase.

MANY methods are in vogue relative to what is commonly termed "increase." The word in this case means adding to the number of colonies. Strong stocks are built up by early feeding, and then are divided, the portion containing the old queen being removed to a new location. As nearly as possible an equal part of brood and stores is given to each, and the remaining space is filled with frames of foundation. Early queens must be reared and introduced to the half that is queenless, or, failing this, a ripe cell should be inserted.

For rapid increase this method is perhaps the best known in bee-culture, and is highly recommended. Always remember a good spring is necessary to ensure the young queens mating in time. If a large number of colonies are required those already divided may be further fed with sugar syrup or sealed stores, until sufficient strength has been gained for a second division. Just here judgment is required as to whether some stocks are too weak for a second division, for only the very strong should be so broken down.

Queen-rearing.

During the summer months every attention should be paid to raising a stock of young queens to replace old and failing ones. Buying new

queens each successive season is too expensive, and with a little attention and care good queens can be raised by the beekeeper in his own yard. An apiary should be requeened as a rule each year, and queens should not be tolerated for more than two seasons at the most. In the long run the queens tell in the production of big crops, and unless the beekeeper takes the trouble to requeen in the summer only a small proportion of the stocks will yield a surplus. Perhaps no branch of apiculture receives less attention than the production of young queens; and yet if the beekeepers who get the big crops of honey are asked what counts most in their production the reply is invariably, "Young queens." In New Zealand it has been proved over and over again that the best period for raising queens is from November to February. During these months everything is favourable for the operation, as the hives are at their highest state of prosperity, and under normal conditions the workers and drones are at their best.

It is best to breed only from pure Italian queens whose correct mating has been assured. Novices can judge the mating by noting the uniformity of the hatching brood as regards colour. Should the young worker bees show diversity of colour—some being yellow-banded and others quite black—the mating has not been correct. The question of mating is always a difficult one, as queens mate on the wing, and therefore it is impossible for the apiarist to select the sires. But as purebred queens, even though mismated, throw pure drones, it only takes a comparatively short time to eliminate crossbred drones from an apiary. There is, however, still the chance of contamination from other drones in the neighbourhood. To sum up the matter, by persistently breeding from the best it is possible to achieve excellent results, while under careless management, or, as is often the case, no management at all, bees are sure to deteriorate.

Methods of queen-rearing are legion, but may be roughly divided into two classes—namely, those which use the naturally built queen-cells, and those which necessitate the provision of artificial queen-cups into which young larvæ are transferred. The former method is most suitable for beginners, or for use early in the season, as it minimizes the risk of chill to young larvæ; while the second method is used largely by beekeepers who want to rear queens in greater numbers.

The Alley System: A simple, efficient, and easy method for raising queen-cells may be found in the Alley plan. It must be understood, however, that when raising queen-cells they require to be large and well-shaped, and that any cells not up to size should be cut out. Procure a frame of young larvæ from the breeding-hive, and with a sharp knife proceed to cut every second row of cells down to the midrib of the foundation. Next kill two out of every three larvæ, and cut the comb into strips about 1 in. wide the full length of the frame. These strips are fastened with melted wax to cell-bars that hang about midway in a standard frame. The cells are pared down to about $\frac{3}{8}$ in. in height, which gives the bees room to construct a solid base for the queen-cell. The frame or frames containing these bars, with the strips attached, may now be put into the hive previously prepared for their reception.

The Miller Method: The Miller method of raising queen-cells will be especially useful to the novice or to the beekeeper wishing a few cells at one time. It is simple, easy, and under normal conditions never fails. No extra appliances are needed. Perhaps no better outline of the Miller system can be given than the original one which appeared in the *American Bee Journal* for August, 1912, as follows:—

"Into an empty brood-frame, at a distance of 2 in. to 3 in. from each end, fasten a starter of foundation about 2 in. wide at the top, and coming down to a point within an inch or two of the bottom bar. Put in the hive containing your best queen. To avoid having it filled with drone-comb, take out of the hive, either for a few days or permanently, all but two frames of brood, and put your empty frame between these two. In a week or so you will

find this frame half filled with beautiful virgin comb, such as bees delight to use for queen-cells. It will contain young brood with an outer margin of eggs. Trim away with a sharp knife all the outer margin of comb containing eggs, perhaps a few eggs next to the youngest brood. This you will see is very simple. Any beekeeper can do it the first time of trying, and it is all that is necessary to take the place of preparing artificial cells. Now put this 'queen-cell stuff,' if I may so call the prepared frame, into the middle of a very strong colony from which the queen has been removed. The bees will do the rest, and you will have as good cells as you can possibly have with any kind of artificial cells. You may think that the bees will start 'wild cells' on their own comb. They won't. At least, they never do to amount to anything, and, of course, you needn't use those. The soft, new comb, with abundant room at the edge for cells, is so much more to their taste that it has a practical monopoly of all cells started. In about ten days the sealed cells are ready to be cut out and used wherever desired."

Nucleus Hives.

In order to facilitate the work of queen-rearing a few nucleus colonies should be run in conjunction with every apiary. In these small colonies queens can be raised and cared for until they are mated and laying. It is an easy matter, once the queens are laying, to transfer them to the larger hives in the apiary.

The best style of nucleus hive to adopt is the four-frame one. This size gives the young queen a chance to lay once she is mated, and, besides, holds sufficient bees to care for relays of queen-cells throughout the season. To form a nucleus colony take one frame of well-capped brood with adhering bees, and one frame containing honey and pollen, the remaining space being filled with an empty comb and feeder. If the number of bees on the comb is not sufficient to form a good cluster, one or two frames of young bees may be shaken into the nucleus, this being done to replace the field bees which return to the old hive. Place the frame of brood in the middle of the hive and close the entrance until the following day, when the bees may be released. In the course of a day or two the small colony settles down, and then is ready to receive the first queen-cell.

Nuclei thus formed should be placed in a shady position until the bees are released. It is a good plan to set them a fair distance apart from each other and away from the main part of the apiary.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

DURING the months of December and January young plants of savoy and red cabbage, broccoli, and cauliflower, Brussel sprouts and kale, leeks and celery are set out for winter cropping. Land from which early crops of potatoes, peas, and salads have been cleared is most suitable for the purpose. Where the initial preparation was good little further preparation will be needed except perhaps for celery, in which case a good dressing of blood and bone, or fish manure, and sulphate of potash, would usually be beneficial. There is often a tendency to force this crop unduly, and the growth is then rank and soft, with considerable loss, very possibly, from fungous and bacterial troubles. Grown steadily, the flavour is improved, and there will be less loss from these causes. On an acid soil all of these crops are greatly improved by an application of lime before planting. Planting at this season must be done with the greatest care to obtain the best results: usually it is necessary to water the plant-beds a day or two before lifting, which should be done in dull weather, and the plants watered

in after planting. The plants should be well rooted and of even size, a sharp watch being kept to avoid those which are "blind" or diseased. Club-root disease is very commonly introduced by setting out infected cabbage plants.

Warm summer days favour the increase of insect pests, so that some protection is usually required during the establishment of these crops. The caterpillars of the white butterfly and diamond-back moth are the common foes of the cabbage family at this season; they may be destroyed before doing serious damage by applying derris dust so soon as the first sign of the attack is perceived, and repeating the application as may be necessary. Green aphides in the hearts of the young plants is also a pest which is commonly present at this period. If they are present when about to plant out, the tops of the plants may be dipped into a solution of nicotine sulphate, one teaspoonful in a gallon of water in which common soap—an inch cube—has been dissolved. Comparative immunity may afterwards be obtained by placing a pinch of tobacco, or nicotine, dust, in the heart of the plant, and so making it distasteful to the insect as a place of residence. The most common trouble threatening the celery crop is of fungous origin and known as leaf-spot, the remedy for which is Bordeaux 3–4–50—*i.e.*, 3 lb. bluestone, 4 lb. hydrated lime, and 50 gallons water. Or washing-soda may be substituted for the lime. Applications should be made at intervals of about three weeks, as may be necessary.

Other crops which may be sown during the above-mentioned period are dwarf beans, early peas, shorthorn carrots, globe beet, turnips, radish, spinach, and lettuce. These are usually the last sowings for the season for all of these crops except spinach and lettuce.

The harvest period for the tomato crop in the unheated glasshouse is now well started, and matters requiring attention chiefly consist of watering, feeding, and attending to ventilation. The outside crop is now well established, and suckering and tying to stakes or wires must be done periodically. In addition to the usual cultivation to suppress weeds, &c., the crop should be watched carefully for any sign of attack from disease or pests. It is now some years since serious losses were incurred by the attack of small moth larvæ tunnelling the main stems of the plants a few inches above the ground, and plants carrying heavy crops collapsed suddenly before the fruit could ripen. This near relation of the potato-moth has been kept under control since by applications, over the vulnerable area more especially, of a solution of arsenate of lead powder, commencing this season.

Early in the month of December, when a good varied supply of early vegetables is available, the harvesting of asparagus should cease and the plants allowed to make normal growth; this usually is greatly assisted by a liberal application of a complete manure at that period.

The pulling of rhubarb also is usually discontinued about that time, which coincides with the commencement of the stone-fruit harvest. A dressing of manures at this stage is usually advisable to encourage vigorous growth.

Where foul land has to be cleaned a summer fallow is often the most effective method when twitch and other bad perennial weeds are present. Generally it is best to plough only moderately deeply, just getting well below the roots of the weeds; then by cultivating and harrowing in fine weather, when the land is dry, the roots are brought to the surface, where they are collected and burnt. The next two or three months are usually the best season for this class of work.

Reports on modern research into horticultural problems are constantly revealing the important part played by many weeds as hosts of insects and disease which affect crops. The work of keeping the crops clean is greatly facilitated by suppressing the weed-growth in their vicinity. By mowing now, with a short weed scythe, hedge bottoms and odd corners of land

where weeds and rank growth have become established, many weeds are killed and others are prevented from seeding, and in all cases the danger from this source is much reduced by this attention. Where young shelter-trees have been planted out in grass this treatment provides a helpful mulch which assists in retaining moisture and admits the light upon which the growth of the young trees depends.

The Homestead Garden.

Where new gardens are to be made it is best to prepare a plan on which ideas may be recorded and adjusted until they harmonize and are well-proportioned. For those who are not accustomed to the work, graph paper 20 in. by 30 in. is very helpful. Its surface is divided usually into squares ten to the inch, and a scale of say, 10 ft. to the inch is easily operated. First draw to scale a plan of the section to be dealt with, then insert a ground-plan of the dwelling and buildings in their respective positions. Follow then with entrance, roads, and service yard, giving access for vehicular and pedestrian traffic. These drives and walks should have an easy grade and be as direct as possible so long as sharp turns, difficult to negotiate with vehicles, are avoided. On flat land there is often no reason why they should not be straight, and they are then best made that way, as there must be no straining after effect. A straight drive planted as an avenue can be most effective if it is well-proportioned.

After laying off areas for orchard, crops, and games, the remainder should be sown down to smooth grass lawns and planted in shrubbery borders. Any decorative features which may be suitable and interesting can be incorporated here. Two features which should receive special consideration, and should be provided as required, are an effective evergreen shelter-belt on the weather side; and such deciduous shade trees as may be necessary on the lee side of the buildings. From this it will be seen that the garden is an integral part of the home in the country; and, in addition to providing a harmonious environment and some supplies of produce, it adds much to the comfort and convenience of the inhabitants. One other point for consideration is that of maintenance. Much of the literature of gardening deals with the production of show blooms for competition—a very fascinating pastime, but the work demands considerable attention. One is also strongly tempted to plant a great variety of plants, some of them delicate or poorly suited to the locality. Those who have not time or inclination to produce crops which require so much attention may secure all of the amenities of the garden by keeping the selection to plants naturally suited to the environment, and planting them in fairly large groups, especially the smaller subjects. The garden need not be less attractive or profitable on that account; in many instances it is quite the reverse.

This is work which cannot be done on the impulse of the moment; many aspects present problems of considerable difficulty which take time to work out satisfactorily. The quality of the finished work depends to a very great extent on the quality of this preliminary preparation. It is best done now so that work may be completed in readiness for sowing down lawns in February–March or August–September and setting out hard-wooded plants during the planting-season, which extends from about May to September inclusive.

Those who have established gardens should also now give them consideration and make definite notes for action at the appropriate season. Time inevitably brings changes, and with a little foresight many of them in the garden will be for the better. Temporary shelter-trees which have served their purpose may be removed, also many "filler" trees and shrubs that are planted out in the early stages of the life of most shrubberies and plantations. Every one makes mistakes, and the planting-season affords an opportunity for putting right some of those made in the garden; as, for instance, the position of specimen trees on a lawn or the wrong position

of a shrub which prefers shade, &c. Many of the best features of a garden can only be planted out satisfactorily when abundant shelter and shade have been established, as for instance, tree ferns, nikau palms, &c. The opportunity is now approaching when brightness, interest, and character may be increased in the garden as required by planning now in some detail such changes as are desirable.

The months of December and January are most suitable for planting out bearded irises. The rich colours and compact growth have brought these plants again into high favour; they have the further advantage of being hardy and requiring very little nursing to obtain a good supply of bloom during spring and early summer. A sunny situation in limestone country is ideal; in the absence of the latter requirement the lime should be liberally provided.

—*W. C. Hyde, Horticulturist, Wellington.*

Citrus culture is making satisfactory headway, especially in the northern districts which are suitable for the production of citrus fruits. The total area now planted in citrus fruit-trees is 1,884 acres, consisting of 1,300 acres of lemons and 584 acres of oranges; 112 acres were planted during the year.—*Annual Report, Director-General of Agriculture.*

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WEATHER RECORDS: OCTOBER, 1936.

Dominion Meteorological Office.

NOTES FOR OCTOBER.

THE first ten or eleven days of October were very windy and rather cool, but otherwise the month was a very mild one. Except in parts of the Wairarapa and southern Hawke's Bay, there has been a vigorous growth of vegetation, and there is ample feed for stock, which are reported to be in very good condition. The milk-yield improved rapidly, and is now high. The lambing-season appears to have been a good one, with relatively few losses owing to adverse weather. As regards fattening, the condition of lambs at the end of the month, though on the whole good, was somewhat variable. In some places the grass was still rather soft. In this respect, however, conditions should soon improve. Crops have made good growth, but the wet condition of the soil has reduced the sowing of spring wheat in Canterbury.

Rainfall.—The rainfall exceeded the average over most of the west coast of the South Island and the Nelson and Marlborough Provinces, but elsewhere it was below. Large parts of the North Island and also of Canterbury had only half the normal fall.

Temperatures were everywhere above normal. In eastern districts and the interior the departures were generally somewhat over 2°, and elsewhere mainly between 1° and 1·5°. Frosts were infrequent and not, in general, severe. A rather sharp one occurred, however, on the morning of the 15th. In the Hastings district, following immediately on a cold rain with snow on the high levels, it caused very serious damage to fruit and tomato crops. A few days later, considerable damage was done in orchards in parts of Central Otago.

Sunshine.—The duration of bright sunshine was generally below average, and especially so in western districts from Taranaki southwards. A few places in the interior and the southern parts of the South Island had more than usual.

Pressure Systems.—During the first eleven days a series of vigorous westerly depressions crossed the Dominion, and north-westerly or westerly gales were blowing in some part or other almost throughout. The gale of the night of the 8th to morning of the 9th was particularly severe, and some damage was done, especially in the Wellington, Westland, and Canterbury Provinces. The gale was accompanied by general rains, which were very heavy on the West Coast and in the high country of the South Island. Floods occurred on the West Coast, that at Greymouth being reported as the highest for twenty-two years. The Waimakariri River, also, was in high flood, the highest level exceeding anything during the preceding sixty years. On the 11th to the 12th the weather changed, the winds turning to southerlies, which were strong about Cook Strait. Some snow fell on the ranges and in the high levels of the South Island. South-westerly weather predominated until the 16th; gales were recorded at times in many places. On the 14th there was again snow on the ranges, and on the following morning severe frosts were experienced in the central part of the North Island. From the 19th to the 27th the pressure systems were much more slowly moving and irregular in form. Useful rains fell, especially in the northern half of the North Island. Temperatures were unusually warm for the time of year.

During the last three days the westerly type of weather again became established. The persistent westerlies were responsible for frequent rains throughout the month in western districts of the South Island, but to the northward the amounts fell off rapidly and eastern districts were, of course, to a large extent shielded from the rains.

RAINFALL FOR OCTOBER, 1936, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Fall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island.			
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Kaitaia	3·99	16	1·54	5·27	48·46	48·93
Russell	4·49	10	1·91	3·98	80·98	45·17
Whangarei	4·31	17	1·23	4·76	58·43	54·71
Auckland	3·15	14	2·00	4·06	45·72	42·58
Hamilton	2·88	16	0·55	4·60	44·67	42·03
Rotorua	2·54	11	0·86	5·19	53·67	47·10
Kawhia	2·42	8	0·73	5·15	48·18	45·90
New Plymouth ..	2·89	16	0·57	5·46	50·66	50·79
Riversdale, Inglewood ..	6·43	18	0·91	10·41	82·35	87·57
Whangamomona ..	..	..	..	8·43	..	64·53
Hawera	1·59	10	0·34	4·65	38·04	38·18
Tairua	2·72	12	0·95	5·81	44·98	56·44
Tauranga	2·58	12	0·74	5·11	48·11	45·52
Maraehako Station, Opotiki	..	..	..	5·35	..	47·29
Gisborne	1·39	6	1·16	2·67	37·34	39·95
Taupo	2·51	11	0·82	4·31	42·20	37·43
Napier	1·23	11	0·85	1·89	41·73	26·12
Hastings	1·12	8	0·47	2·11	36·20	28·16
Whakarara Station ..	3·25	12	0·92	..	47·61	..
Taihape	1·79	16	0·39	3·50	37·56	30·06
Masterton	3·08	10	1·32	3·24	41·16	32·78
Patea	2·77	15	0·66	4·25	41·80	37·28
Wanganui	2·14	9	0·57	3·46	34·17	30·18
Foxton	2·36	12	0·77	2·94	34·43	26·67
Wellington	3·33	14	1·15	3·51	46·28	36·38
			South Island.			
Westport	..	..	..	8·70	..	79·50
Greymouth	11·33	22	2·17	10·74	77·62	83·80
Hokitika	11·40	21	2·34	11·81	86·64	94·12
Ross	16·07	20	3·30	14·77	106·39	109·58
Arthur's Pass ..	30·43	18	7·08	20·33	118·26	131·69
Okuru, South Westland	19·97	14	4·98	15·21	130·41	120·90
Collingwood	8·90	15	1·95	10·08	80·34	82·03
Nelson	4·10	9	1·19	3·50	35·64	31·94
Spring Creek, Blenheim	2·73	10	0·93	2·56	31·03	25·79
Seddon	1·73	10	0·60	2·23	24·43	20·99
Hanmer Springs ..	5·38	14	2·43	3·92	48·50	37·83
Highfield, Waiau ..	..	..	..	2·60	..	28·12
Gore Bay	..	..	..	2·33	..	26·58
Christchurch	0·98	10	0·31	1·97	28·64	20·89
Timaru	0·64	6	0·29	1·98	23·57	18·31
Lambrook Station, Fairlie	1·81	7	0·54	2·06	22·39	20·37
Benmore Station, Clearburn	..	..	..	2·30	..	20·25
Oamaru	0·95	7	0·34	1·76	20·48	17·84
Queenstown	4·79	16	1·07	3·31	31·68	25·28
Clyde	1·52	7	0·58	1·62	11·91	12·12
Dunedin	2·86	11	1·51	3·09	37·21	29·97
Wendon	2·64	11	0·90	2·73	25·80	24·42
Balclutha	..	..	..	2·52	..	20·58
Invercargill	4·28	18	1·00	4·35	39·65	37·37
Puysegur Point ..	11·19	26	1·62	8·13	87·82	69·84
Half-moon Bay ..	..	..	..	5·16	..	48·10